The Mysore Agricultural Journal

(The Organ of the Mysore Farmers' Forum)

Vol. XXXII] January—March 1957 [No. 1

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FEEDING OF MILCH CATTLE

DEVELOPMENT OF CASHEWNUT CULTIVATION AND INDUSTRY IN MYSORE

KEMPU—AN IMPROVED VARIETY OF ITALIAN MILLET, *NAVANE*

THESE FASCINATING INSECTS—II

Egyptian Cotton under Mysore Conditions does not Respond to Nitrogen Alone—Phosphate and Potash Enhance Cotton Yield

(From the Indian Central Cotton Committee)

THE results of the experiments conducted under the Mysore Physiological Scheme financed by the Indian Central Cotton Committee, revealed that Egyptian cotton under Mysore conditions did not respond to the application of nitrogen alone and that better yields were obtained only when nitrogen was supplemented with either phosphate or potash, or both.

At the Visvesvaraya Canal Farm, application of 100 lb. of phosphoric acid or 50 lb. of potash significantly increased the yield. The highest yield of 480 lb. per acre was recorded under NPK treatment against 217 lb. of seed cotton in the control plots, indicating the need for the application of all the three elements under the Mysore conditions. The need for phosphatic manures has been clearly demonstrated by the yield data given below :

Treatment	Average yield of seed cotton in lbs. per acre	Treatment	Average yield of seed cotton in lbs. per acre
Control	.. 217	PK	.. 258
N	.. 196	NP	.. 260
P	.. 338	NK	.. 312
K	.. 260	NPK	.. 484

Almost a similar trend in yield was obtained at the Babbur Farm also. Here, phosphate alone increased the yield to 503 lb. per acre as against 476 lb. of control, while potash alone had no effect. The complete fertiliser N + P + K raised the yield to 620 lb. per acre. N alone has given less yield than the control. Mean yield of seed cotton in lb. per acre obtained at Babbur Farm under different treatments is indicated below :

Treatment	Yield of seed cotton in lbs. per acre	Treatment	Yield of seed cotton in lbs. per acre
Control	.. 417	PK	.. 395
N	.. 394	NP	.. 412
P	.. 503	NK	.. 355
K	.. 345	NPK	.. 620

This again confirms the conclusion that manuring Egyptian cotton with nitrogen alone is of less consequence under Mysore conditions unless supplemented by phosphorus and potash.

The
Mysore Agricultural Journal

Organ of the Mysore Farmers' Forum
Cenotaph Road, Bangalore-2

Vol. XXXII *January to March 1957* *No. 1*

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Published quarterly. Copies are obtainable from the Secretary at Re. 1-8-0 per copy or by subscription at Rs. 6 a year. Non-editorial correspondence should be addressed to the Secretary. Editorial communications, new exchanges and books for review, may be addressed to the Editor, MYSORE AGRICULTURAL JOURNAL, *Department of Agriculture, Seshadri Road, Bangalore-1.*

(The Mysore Farmers' Forum does not accept responsibility for facts or opinions expressed by contributors.)

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EDITORIAL

RETIREMENT OF Dr. B. DASAPPA

Dr. Belavadi Dasappa, B.A., B.Ag., Ph.D., D.I.C., Deputy Director of Agriculture, retires on 16-4-1957, after a long period of devoted and distinguished service in the Mysore State Department of Agriculture.

Born on 16th April 1902, in the famous Belavadi family which has contributed eminent administrators to the State, he was educated at the London Mission High School and Central College in Bangalore. Graduating in 1923, he joined the Department as Analyst in the Division of Agricultural Chemistry. In order to equip himself for better service in the cause of Mysore agriculture, he took leave and joined the Poona Agricultural College where he studied under such giants as Dr. W. Burns, Dr. Sahasrabuddhe, Sri. V. G. Gokhale and Dr. Uppal. His career there was crowned with a First in First Class at the B.Ag. Examination of 1932. He returned back to the Department but his zest for knowledge remained unabated and was constantly whetted by his chief and brilliant agricultural chemist Dr. B. Narasimha Iyengar. He secured the coveted Damodardas Scholarship and sailed to England in October 1934. He joined the Imperial College of Science and Technology and worked for his Ph.D. of the London University. The subject of his Doctorate thesis was "Effect of Decomposition of Organic Matter on the Composition of Soil Solutions". After obtaining his Doctorate and the Diploma of the Imperial College in 1937, he worked for a few months at the University College of N. Wales at Bangor under that distinguished soil scientist and savant, Prof. G. W. Robinson. In spite of the Professor's persuasion to stay on in England, he returned back in March 1937 to Mysore to serve his State and country.

He was soon elevated to the gazetted rank as Assistant Director of Agriculture. His service in the districts—he served in four (Mysore, Bangalore, Mandya and Shimoga), was marked by sincerity, devotion and hard work. Wherever he went, he won the affection, confidence and respect of farmers and colleagues. His popularity in the districts—particularly Shimoga District—remains undiminished to this day.

His services were sought by the Central Government in 1940 for heading the Agricultural Department in Coorg, but Mysore could not afford to spare such a valuable officer.

When the Mysore Agricultural College was started in 1946, there was none better qualified than he, both by academic brilliance and sound district work, to head the Division of Agronomy. With the promotion of Dr. B. T. Narayanan, he was appointed as Principal of the College in 1953.

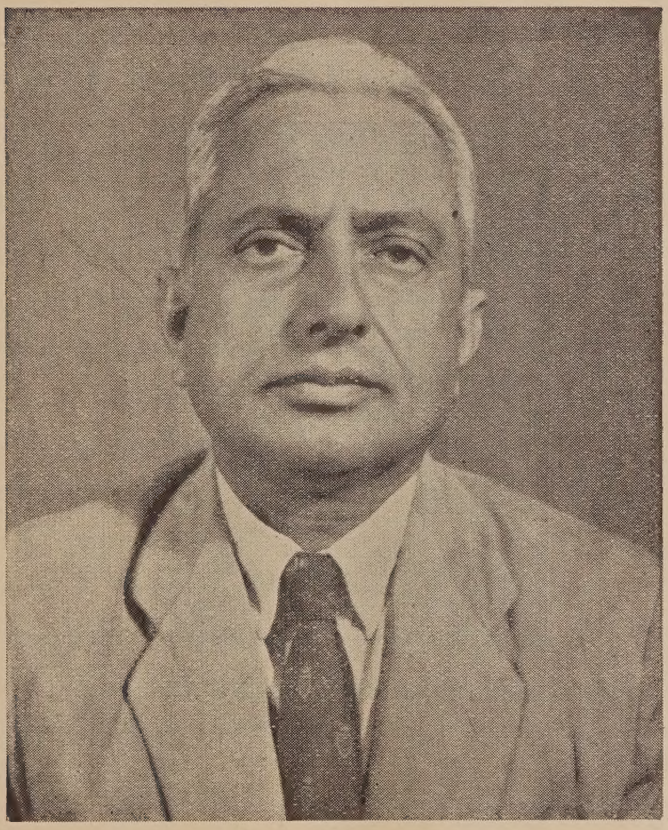
He was promoted as Deputy Director of Agriculture in 1955. He was intimately connected with the Mysore Agricultural and Experimental Union (now Mysore Farmers' Forum) and was Chairman of the Editorial Board of this *Journal* for some time.

Unostentatious, modest, friendly, upright, Dr. Dasappa endeared himself to all his colleagues and assistants in the Department. He had an even temper and a friendly approach to every one of his subordinates. Dr. Dasappa carried his powers lightly and never exercised it to injure or harm or hurt any of his staff, however great the provocation. Once, when a particularly intractable assistant put up a perfunctory draft, Dr. Dasappa simulated great indignation and said, "you are forcing me to do a thing which I have never done in my life. I will never fine you." This had the desired effect.

Another of his endearing qualities was lack of any show in dress, demeanour or design of living. Once this writer asked him why he did not buy a car. Pat came the characteristic answer, "I invest on my children and not on gadgets."

Dr. Dasappa is one of those persons who can never be happy without company. He is very fond of talking and innocent gossip. He has a large *reportoire* of anecdotes to regale his listeners with. He has a delicate sense of humour and his face is always wreathed in smiles. He believes in the motto, "Laugh and the world laughs with you ; weep, and you weep alone."

We are happy to learn that his rich experience will be utilised by the Government of India. We, on behalf of this *Journal,* wish him health and happiness in his retirement.



DR. B. DASAPPA

Sri. N. KRISHNA IYENGAR

SRI. N. KRISHNA IYENGAR

We regret to record with deep regret the death on 24-1-1957, of Sri. N. Krishna Iyengar of Uragahalli Estate. He was one of the founder-members of the Mysore Agricultural and Experimental Union established in 1918. He was probably the first graduate to settle down on his land and what is more, to make a grand success of it. For many years, his estate was the testing ground of all suggestions and recommendations emanating from the Agricultural Department. He and the late Dr. L. C. Coleman were great friends and their happy association lasted for several decades.

We offer, on behalf of this *Journal*, our deep condolences to the bereaved family.

NOTES ON SOME PREDATORS OF MEALY-BUGS (COCCIDÆ, HEMIPTERA)

By Dr. M. Puttarudriah and G. P. Channa Basavanna[1]

Mealy-bugs like other bugs are sucking insects. Ayyar (1941) in his paper on South Indian mealy-bugs states that the subfamily Dactylopiinæ includes bugs which are popularly known as "mealy-bugs", and certain genera like *Drosichiella* and *Icerya*, under the subfamily Monophlebinæ, also come under this group. Among the different genera listed under Dactylopiinæ, *Pseudococcus* and *Phenacoccus* are very common and often assume a serious status as pests of fruit, vegetable and ornamental plants. The female mealy-bugs are fleshy and soft-bodied and more or less covered with a whitish or yellowish powdery wax which is sometimes produced into whitish processes on the body rendering the bugs more conspicuous. Several hundreds of eggs are generally laid in masses hidden under a regular cottony ovisac or amongst loose mass of waxy filaments. The young ones that emerge out of the eggs crawl about, feed on the plant sap and finally grow to the adult stage. The females are able to move about, although slowly, during their entire life. The males are small, delicate, two-winged insects.

Mealy-bugs are among the most common insect pests attacking a wide variety of plants—the perennials, like some of the fruit and ornamental plants and the short-lived plants, like vegetable crops and even some cereals. The most common regions that are infested in a plant are the leaves and tender twigs, though fruits, flowers and even hardier stems are not immune to attack by the mealy-bugs. There are mealy-bugs which infest even the root region of plants within the soil [like *Dysmicoccus brevipes* (Ckll.) on areca seedlings and others on the roots of brinjal and potato]. They injure plants by constantly sucking sap, as a result of which the tender twigs and leaves are deformed and stunted in growth. Such injury especially in annuals and short-lived vegetable and ornamental plants will seriously affect the growth and yield of the crop. Besides, the honey dew they excrete, attracts ants and sooty mould, making the plants appear ugly and the products unsaleable in certain

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cases on account of discolouration. In cases of heavy and extensive deposit of the sooty mould, the photosynthetic activity of the plants may be adversely affected resulting in leaf-fall and ultimate death of the infested plant.

A number of predators has been recorded previously by various workers in India upon different species of mealy-bugs ; but most of the records are scattered. Most of these pertain mainly to either biological or taxonomical accounts of certain mealy-bugs, incidentally making mention of a few predators. Among these may be mentioned the record of a few predators upon cotton mealy-bugs made by MISRA (1920), that by SURBAMANIAM (1955) upon Iceryne scales ; and by PUTTARUDRIAH (1954) on the sugarcane mealy-bug, *Saccharicoccus sacchari* (Ckll.) ; and by AYYAR (1930 and 1941) on certain of the mealy-bugs.

Here it is proposed to list the various predators reared from different species of mealy-bugs during the last two years together with brief notes on their biology wherever possible. These observations were made mainly in connection with our survey for Coccinellid predators in the State. As mealy-bugs happen to be at times some of the worst pests of fruit, ornamental and vegetable crops, this preliminary contribution towards the predatory fauna of this important group of crop pests is made, and it is hoped to be followed up in an effort to utilise some of the more promising ones in the control of the mealy-bugs. It is also interesting to note that some of the predatory larvæ like *Cryptolæmus montrouzieri* Muls., several species of *Pullus* and *Scymnus* and the lycænid, *Spalgis epius* Westwood, superficially resemble the mealy-bugs in having a whitish coat of waxy material, and are thereby apt to be mistaken for the pest insects (mealy-bugs). There are others like the larvæ of *Chrysopa* sp., which move about, carrying a cover of cast skins, etc., among the colonies of mealy-bugs and again hard to detect their presence amongst the masses of bugs.

Generally, the Coccinellids or the ladybird beetles are amongst the most common predators of mealy-bugs. There are also others like the lycænid butterfly (*Spalgis epius* Westwood), the flies (*Gitnides perspicax* Knab and *Leucopis luteicornis* Mall) and species of green lacewings (*Chrysopa* sp.), which at times become quite numerous and exercise a good controlling influence along with other groups of predators.

On many occasions the predators form the main factor in almost wiping out the mealy-bug population in a limited locality. It can be even said that the mealy-bug problem on our different orchard and ornamental plants would have been, perhaps, more serious but for the beneficial insects, which are, unnoticed by most of the cultivators, quite helpful in combating this serious pest, which is rather difficult by chemical means. On this ground they need encouragement by all means by the cultivators, and for that purpose their presence amidst the mealy-bug infestations has to be recognised particularly before we think of applying an insecticide to control the mealy-bug pest.

The predators are listed under the order and family to which each belongs, together with biological notes. At the end a predator-host list is also tabulated for the purpose of ready reference.

COLEOPTERA

Coccinellidæ

Amongst the several species of ladybird beetles, the Australian ladybird beetle, *Cryptolœmus montrouzieri* Muls., and *Pullus elegans* Sic., are often the most common and usually abundant on mealy-bugs of the genus *Pseudococcus*. Infestations of the fluted scale, *Icerya purchasi* Mask., usually support one or more species of *Rodolia*, particularly *R. cardinalis* Muls., and *R. amabilis* Kapur. The striped coccinellid, *Brumus suturalis* (Fabr.) is most common on the brinjal mealy-bug, *Phenacoccus insolitus* Green.

Rodolia cardinalis Muls.

This Australian ladybird beetle was imported for the control of the fluted scale, *I. purchasi* in South India. The species has established itself well in Mysore and is commonly found in all its stages amongst the fluted scales on casuarina trees.

Subramaniam (1954 and 1955) has given a detailed account of its incidence, etc., in South India.

Rodolia amabilis Kapur

This species is sometimes found along with the above species and at times found to be more common than the imported species in certain localities.

Subramaniam (1955) has given the life-cycle and its capacity as a predator.

Rodolia breviuscula Weise

This predator has been found feeding upon the mealy-bug, *Icerya seychellarum* Westwood, around Bangalore and Mysore. It has also been noted to breed extensively upon the scale, *Labioproctus polei* (Green) infesting *Thevetia* hedge plant.

A large number of these predators, in all stages, was noticed feeding upon the young ones of the coccid on *Thevetia* plants in a compound near the buildings of the Agricultural Department, Bangalore, during March-May 1953.

Subramaniam (1955) has recorded the species as feeding upon *I. ægyptiaca* Green and also as taking to *I. purchasi,* and he also gives the life-cycle of the predator.

Rodolia ruficollis Muls

The beetles of this species were reared from an unidentified mealy-bug infesting sandal trees near Bangalore.

Cryptolæmus montrouzieri Muls.

Though this Australian ladybird beetle was imported into South India (Mayne, 1953) as early as 1898, it had gone on unnoticed till 1951 when it was reported from Mysore (Puttarudriah *et al.,* 1952 & 1953). Since then the predator has been found to be very common on various species of *Pseudococcus* infesting a variety of plants like guava, mango, mulberry, *Boehmeria,* etc., and also found feeding upon *P. insolitus* and *I. ægyptiaca* to a lesser extent. It has also been found feeding upon other scale insects like, *Pulvinaria psidii* Mask., *P. maxima* Green and *Eriococcus araucariaæ* Mask. The predator is found almost throughout the year around Bangalore. The grubs have a close superficial resemblance to mealy-bugs in having a covering of white mealy processes.

David and Muthukrishnan (1953) have recorded the predator on the cactus cochineal, *Dactylopius tomentosus* Lam.

Pullus elegans Sic.

This tiny coccinellid is found to be very common amongst infestations of different species of *Pseudococcus* infesting a large variety of plants. The grubs and adults are seen to be actively feeding upon the mealy-bugs almost the entire year,

It is very rare to see infestations of *Pseudococcus* spp., on exposed portions of plants without the presence of this predator. The grubs which are amidst the mealy-bugs are apt to be overlooked on account of their small size and further their bodies having a white waxy coat.

Pullus gratiosus WSE., VAR.

The species was found in large numbers on *Ferrisiana virgata* Ckll., infesting the fibre plant, *Boehmeria* sp. Both the grubs and adults were abundant feeding on the mealy-bug during the summer months. Beetles were also bred out of the fluted scale (*I. purchasi*)-infested casuarina twigs collected at Mandya (Mysore) during May. The species had not so far been recorded as a predator of the fluted scale in India.

Pullus nubilus MULS.

This common predator of several species of aphids has been noticed feeding upon the brinjal mealy-bug, *P. insolitus* during April around Bangalore. Grubs were also found burrowing into the egg-masses and feeding on the eggs of the mealy-bug.

MISRA (1920) has recorded *Scymnus nubilus* on the cotton mealy-bug, *P. corymbatus* Green, from North Bihar.

Pullus victoris MOTSCH., VAR.

The species was found together with *P. gratiosus* on *Ferrisiana virgata*, infesting *Boehmeria* plants during summer months.

Pullus SP. NR. *pallidicollis* MULS.

This ladybird beetle was reared out of the mealy-bug (*Pseudococcus* sp.)-infested betel vine received from Chitaldrug (Mysore) during April-May 1953. Grubs and adults were found in small numbers amidst the mealy-bug colonies on the leaves and twigs.

Pullus SP.

This undetermined species of *Pullus* and quite distinct from the above ones, was found feeding upon the mealy-bug, *F. virgata* infesting guava around Bangalore.

Scymnus SP.

The beetles of this species were bred out of the brinjal mealy-bug, *P. insolitus* and were found together with *P. nubilus*.

Nephus regularis Sic.

This is also a common species found almost throughout the year, usually in small numbers. The predator is noted to feed upon the brinjal mealy-bug, *P. insolitus* and also *Pseudococcus* sp. infesting a number of plants like guava, *Boehmeria* and *Gliricidia* plants.

Nephus sp.

The beetles of this species have been reared out of the sugarcane mealy-bug, *Saccharicoccus sacchari* Ckll., infesting sugarcane round about Mandya (Mysore) during August.

Nephus sp. nr. *quadrimaculatus* Herbst.

This species has been collected on cotton plants infested with *P. corymbatus* near Bangalore.

Pseudaspidimerus circumflexa (Motsch.) var. *testaceus* Weise

This species which is commonly known to feed upon different species of aphids (Puttarudriah & Channa Basavanna, 1956), has been found to feed upon *F. virgata* on *Boehmeria* plants during May. Beetles have also been collected from mealy-bug-infested sandal trees during October near Bangalore.

Hyperaspis maindroni Sic.

The predator was quite abundant during summer months on guava and *Boehmeria* plants infested with *F. virgata* around Bangalore. Grubs and adults of the predator were found in large numbers particularly on mealy-bug-infested *Boehmeria* plants during the above months.

Chaterjee (1954) has recorded this species on *P. insolitus* from Calcutta.

Hyperaspis maindroni Sic. var. *brumoides* Sic.

This variety of the species was found in small numbers along with the above species on mealy-bug-infested *Boehmeria* plants near Bangalore. The same variety was found to be quite abundant upon *P. corymbatus*, infesting cotton round about Hiriyur (Mysore) during January 1954. Both adults and grubs were seen actively feeding upon young ones of the mealy-bugs.

Sticholotis sp. ? 4-*signata* Weise

A few beetles of this species were collected from mealy-bug-infested sandal trees near Bangalore during May.

Jauravia (= *Clanis*) *soror* (WEISE)

The beetles were collected from mealy-bug-infested sandal trees near Bangalore during May.

Pharoscymnus horni (WEISE)

The adults have been reared out of the sugarcane mealy-bug, *S. sacchari*, collected around Mandya and also near Bangalore during January and Setpember. In addition, the species has been noted to feed upon a few other species of hard scales (PUTTARUDRIAH & CHANNA BASAVANNA, 1956).

Chilocorus nigritus (FABR.)

This species, which is usually a predator upon the coffee green bug [*Coccus viridis* (Green)] and various other scale insects was noted in small numbers on *Pseudococcus*-infested cotton near Bangalore. Actual feeding upon the mealy-bugs was not noticed.

Brumus suturalis (FABR.)

This is a fairly common species, the grubs and adults of which were found often upon the brinjal mealy-bug, *P. insolitus*. The predator is particularly abundant on brinjal plants infested with the mealy-bug almost throughout the year. The species was also found feeding on *Pseudococcus* spp., infesting cotton, *Thevetia, Pongamia* and *Crotalaria*.

KAPUR (1942) has worked out the life-history, etc., of the predator and has also compiled the list of hosts recorded in India.

Menochilus 6-maculatus (FABR.)

This is a very common and widely distributed species in India, especially common on different species of aphids. It is also seen feeding, though in small numbers, upon the mealy-bug, *Pseudococcus* spp., infesting different kinds of plants. Much variation in colour patterns of beetles of the species is met with in the populations in nature. Four different patterns may be clearly noticed though there are several intermediaries: (1) Characteristic black markings with colour of the elytra varying from light yellow to almost red; (2) No black markings but with a median longitudinal black line when the elytra are in a resting position; (3) Different patterns of black bands; and (4) Elytra completely black.

Nitidulidæ

Clausen (1940) has reported records of a few species of nitidulids as predaceous upon aphids and coccids, and more particularly species of *Cybocephalus* which have been recorded as feeders upon some scale insects. Two species of *Cybocephalus* have been reared out of mealy-bugs here.

Cybocephalus semiflavus Champ.

This species has been reared out of *Pseudococcus* spp., infesting a variety of plants around Bangalore, during May-June. The beetles have also been reared out of mealy-bug-infested sandal twigs collected near Bangalore.

Cybocephalus sp. ? *puncticeps* Grouv.

The beetles have been obtained from mealy-bug-infested sandal trees near Bangalore during May. The beetle has a close superficial resemblance to the above species.

Dermestidæ

Clausen (1940) has stated that, though the members of this family are known to feed upon dead animal and plant materials, a few species are known to be predaceous upon particularly eggs of certain insects like mantids and some Lepidoptera.

Apsectus indicus Arrow

The beetles have been reared out of infestations of several species of aphids on different plants, the red mite (*Raoiella indica* Hirst.) on areca palm, and *Pseudococcus* sp., on guava plants. Beetles have been obtained from these infestations almost throughout the year. The actual role of this dermestid is not known, though this is very common at times.

DIPTERA

Drosophilidæ

Great majority of species of this family breed in decaying fruits, etc., and a small number of them are predaceous or parasitic (Clausen, 1940). *Gitonides perspicax* Knab has been reported to be a predator upon mealy-bugs of different species.

Gitonides perspicax Knab

This is a common fly, the maggot of which feeds upon the mealy-bugs, particularly different species of *Pseudococcus*

infesting various plants. The flies have also been reared out of infestations of *S. sacchari*, on sugarcane. The predator is common almost throughout the year around Bangalore. Infestations of mealy-bugs do not readily disclose the larval stages of the predator, but if the mass of the mealy-bugs is teased, the predatory maggots are revealed and so also the puparia of the fly.

Puttarudriah (1954) has recorded this species as predaceous upon the sugarcane mealy-bugs from Mandya (Mysore). Misra (1920) has recorded this fly predator upon *P. corymbatus* and *Phenacoccus hirsutus* Green, infesting cotton in North Bihar (North India). Malloch (1924) has reported the same upon *P. corymbatus* from Coimbatore (South India). The rice mealy-bug, *Ripersia oryzæ* Green, has also been reported to be the host of this drosophilid in South India (Ayyar, 1939).

Chamæmyiidæ

The larvæ of most of the species under this family (also known as Ochthiphilidæ), principally species of the genus *Leucopis*, are known to be predaceous upon mealy-bugs and aphids (Clausen, 1940).

Leucopis (= *Neoleucopis*) *luteicornis* Mall.

The maggots of this species have been noted to be very commonly predaceous upon aphids and also on mealy-bugs of the genus *Pseudococcus*. The mealy-bugs (*Pseudococcus* spp.) infesting cotton, *Sesbania, Crotalaria* and guava have been noted to be attacked by the maggots of this fly almost throughout the year, and in summer the flies are most abundant.

Malloch (1924, *a*), while describing the species has reported this to be "parasitic on Rain tree mealy-bug (*Phenacoccus iceryoides* Green)" from Coimbatore.

Ayyar (1939) has recorded the species upon the rice mealy-bug *Ripersia oryzæ* in South India.

Itonididæ (= Cecidomyiidæ)

Although the great majority under this family are gall gnats or gall midges, a good number of species are parasitic and predaceous upon different groups of insects, particularly aphids, coccids and mites (Clausen, 1940).

Diadiplosia indica Felt

The maggots of this species were noted to feed upon the mealy-bug (*Pseudococcus*)-infested guava and cotton plants

near Bangalore during almost the entire year. Sometimes the fly becomes quite abundant.

The species has been previously recorded as a predator upon *Pseudococcus corymbatus* and *Phenacoccus hirsutus* Green infesting cotton in North Bihar (Misra, 1920).

Ayyar (1930) has reported the species as predaceous upon *P. virgatus, P. filamentosus* Ckll. var. *corymbatus* Green, and *Phenacoccus hirsutus,* in South India.

Lonchæidæ

The great majority of species of the family breed in decaying vegetation and only an occasional species is predaceous (Clausen, 1940).

Lonchœa sp.

Flies of this species were reared out of the sugarcane mealy-bug, *S. sacchari,* collected near Mandya during August. The exact relation of these flies to the mealy-bug is not known. However, Clausen (1940) has stated that Taylor has reported *Lonchœa corticis* Taylor as predaceous upon the larvæ of *Pisodes strobi* Peck, and related beetles.

Milichidæ

Clausen (1940) has stated that the adults of this family are quite consistently insect feeders. In view of this statement it is worth while to investigate the relationship of the fly reported here with the mealy-bug upon which it was found.

Milichia sp. ? *posticalis* Beck.

The flies of this species have been bred from *Pseudococcus* sp., infesting casuarina plants, and collected near Bangalore. The relation of this insect with the mealy-bug is not definitely known. They were also reared out of the mealy scale, *Pulvinaria psidii* Green infesting guava.

Chloropidæ

Though the family in general is phytophagous in habit, there are a few species which are predaceous upon other insects. An undetermined species (nr. *Epimadiza*) of this family was reared out of the sugarcane mealy-bug, *S. sacchari,* collected at Mandya during August. Its relation with the mealy-bug is not definitely known.

LEPIDOPTERA

Lycænidæ

A large number of species are known to be predaceous upon Aphididæ and Coccidæ (particularly *Pseudococcus*), and species of *Spalgis* are most frequently found as predators of mealy-bugs, though they attack aphids also (Clausen, 1940).

Spalgis epius Westwood

This species though a rare one, has been noted to become abundant at times upon *Pseudococcus* spp., infesting a variety of plants. The caterpillars which are short, stout and fleshy and covered with mealy material and which are hard to detect amidst mealy-bugs, have been noted to be common upon *Pulvinaria* sp., also. Pupation takes place amidst the mealy-bugs and the pupa presents a curious appearance closely resembling the face of a monkey.

Among the mealy-bugs, *Phenacoccus iceryoides* (Green), *Pseudococcus lilacinus* (Ckll.) and *P. citri* R., have been previously recorded as hosts of this predator in South India (Ayyar, 1930 & 1930, *a*). Misra (1920, *a*) has recorded the species as predatory upon *Phenacoccus hirsutus* infesting mulberry in North Bihar.

Phycitidæ

Several members of this family are predatory in habit.

Euzophera cocciphaga Hampson

The caterpillars of this moth are seen occasionally webbing amidst the fluted scale, *Icerya purchasi* and feeding upon the scale. The moths were reared out of the fluted scales collected at Mandya and also at Bangalore.

Subramaniam (1955) has recorded the predator on the same host in a few places in Mysore State. Ayyar (1930, *a*) has reported the species upon the scale, *Aspidoproctus xyliæ* Green.

Cryptoblabes sp.

On one occasion, a moth of this species was reared from *Pseudococcus*-infested guava. Its relation with the mealy-bug is not known, though there has been a record of *Cryptoblabes gnidiella* Mill. feeding upon various stages of *Aleurocanthus* spp., in Malaya (Clausen, 1940).

Another undetermined phycitid was reared out of *Pseudococcus* on cotton near Bangalore during September.

NEUROPTERA

Chrysopidæ

The larvæ are known to feed upon various soft-bodied insects.

Chrysopa sp.

This undetermined species of *Chrysopa* has been found feeding commonly upon *Pseudococcus corymbatus, Ferrisiana virgata* (Ckll.), and *Phenacoccus hirsutus* Green. The species is commonly met with almost throughout the year, and also becomes abundant at times particularly during summer months.

Ramchandra Rao (1919) has recorded a species of *Chrysopa* upon *Pseudococcus* sp. (*virgatus* ?) collected on *lantana* near Bangalore.

HEMIPTERA

Lygæidæ

The great majority are phytophagous feeding upon different plants. But a few are known to be predaceous in habit (Clausen, 1940).

Geocoris tricolor Fabr.

This is a common species which has been seen feeding upon the species of *Pseudococcus* infesting various plants around Bangalore, almost throughout the year. Both nymphs and adults are active amidst colonies of mealy-bugs and sucking the young ones and adults of the mealy-bugs.

Anthocoridæ

Only a few species of this family like *Triphleps* and *Acanthocoris* are known to be predaceous upon other insects (Clausen, 1940).

Piezostethus sp.

A large number of adults and nymphs of this predator were seen among the sugarcane mealy-bug infestations around Mandya and were noticed to suck the mealy-bugs.

PREDATOR-HOST LIST

(ARRANGED ALPHABETICALLY UNDER EACH ORDER)

Predator	*Family*	*Hosts*	*Remarks*
		COLEOPTERA	
Apsectus indicus Arrow.	DERMESTIDÆ	*Pseudococcus* sp. on guava	Relation with the mealy-bug is not known
Brumus suturalis (Fabr.)	COCCINELLIDÆ	*Phenacoccus insolitus*; *Pseudococcus* spp.	Very common on *P. insolitus*
Chilocorus nigritus (Fabr.)	,,	*Pseudococcus* sp. on cotton	
Cryptolæmus montrouzieri Muls.	,,	Different species of *Pseudococcus*, *Phenacoccus insolitus* Green, *Icerya ægyptiaca* Green, *Pulvinaria psidii*, Mask., *P. maxima* Green, *Eriococcus araucariæ* Mask.	Very common, found almost throughout the year.
Cybocephalus semiflavus Champ.	NITIDULIDÆ	*Pseudococcus* spp., mealy-bug-infested sandal trees	———
C. sp. ? *puncticeps* Grouv.	,,	Mealy-bug-infested sandal trees	———
Hyperaspis maindroni Sic.	COCCINELLIDÆ	*Ferrisiana virgata*	Very common in summer months
H. maindroni Sic. var. *brumoides* Sic.	,,	,, *Pseudococcus corymbatus*	Abundant on *P. corymbatus*
Juaravia (= *Clanis*) *soror* (Weise)	,,	Mealy-bug-infested sandal trees	———
Menochilus 6-maculata (Fabr.)	,,	*Pseudococcus* spp. on different plants	———
Nephus regularis Sic.	,,	*Phenacoccus insolitus* *Pseudococcus* sp.	———
Nephus sp.	,,	*Saccharicoccus sacchari* Ckll.	———
Nephus sp. nr. *quadrimaculata* Herbst.	,,	*Pseudococcus corymbatus*	———

Pharoscymnus horni (Weise)	,,	*S. sacchari*	———
Pseudaspidimerus circumflexa (Motsch) var. *testaceus* Wse.	,,	*Ferrisiana virgata* Mealy-bug-infested sandal trees	———
Pullus elegans Sic.	,,	Different species of *Pseudococcus*	Very common
Pullus gratiosus Wse., var.	,,	*Ferrisiana virgata* *Icerya purchasi*	Common on *Ferrisiana* in summer
Pullus sp.	,,	*Ferrisiana virgata*	———
P. nubilus Muls.	,,	*Phenacoccus insolitus*	
P. sp. nr. *pallidicollis* Muls.	,,	*Pseudococcus* sp.	Found in small numbers
P. victoris Motsch. var.	,,	*Ferrisiana virgata*	———
Rodolla amabilis Kapur.	,,	*Icerya purchasi*	Sometimes more abundant than *R. cardinalis*
R. breviuscula Weise.	,,	*I. seychellarum* West. *Labioproctus polei* (Green)	Very common on *Labioproctus*
R. cardinalis Muls.	,,	*Icerya purchasi* Mask.	Quite common
R. ruficollis Muls.	,,	Unidentified mealy-bug on sandal trees	Rare
Scymnus sp.	,,	*Phenacoccus insolitus*	———
Sticholotis sp. ? *4-signata* Weise.	,,	Mealy-bug-infested sandal trees	———

DIPTERA

Diadiplosis indica Felt	ITONIDIDÆ	*Pseudococcus* sp. on guava and cotton	Present throughout the year
? *Epimadiza*	CHLOROPIDÆ	*Saccharicoccus sacchari*	———
Gitonides perspicax Knab.	DROSOPHILIDÆ	*Pseudococcus* spp. on different plants *S. sacchari*	Common throughout the year
Leucopis (= *Neoleucopis*) *luteicornis* Mall.	CHAMÆMYIIDÆ	*Pseudococcus* spp.	Present throughout the year
Lonchæa sp.	LONCHÆIDÆ	*S. sacchari*	———
Milichia sp. ? *posticalis* Beck.	MILICHIDÆ	*Pseudococcus* sp. on casuarina *Pulvinaria psidii* Green	———

Predator	*Family*	*Hosts*	*Remarks*
		LEPIDOPTERA	
Cryptoblabes sp.	PHYCITIDÆ	*Pseudococcus* sp. on guava	Whether predaceous, not known
Euzophera cocciphaga Hampson	„	*Icerya purchasi*	
Phycitid (unidentified)	„	*Pseudococcus* sp. on cotton	Relation not known
Spalgis epius Westwood	LYCÆNIDÆ	*Pseudococcus* spp. *Pulvinaria* sp.	Sometimes abundant
		NEUROPTERA	
Chrysopa sp.	CHRYSOPIDÆ	*Pseudococcus corymbatus* *Ferrisiana virgata* *Phenacoccus hirsutus* Green	Common and at times abundant
		HEMIPTERA	
Geocoris tricolor Fabr.	LYGÆIDÆ	*Pseudococcus* sp. on different plants	Common almost throughout the year
Piezostethus sp.	ANTHOCORIDÆ	*Saccharicoccus sacchari*	Quite common

Most of the predators here reported have been determined through the courtesy of the Director, Commonwealth Institute of Entomology, London, to whom our thanks are due.

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(Received : 3rd August 1956)

FERTILIZER DEMONSTRATIONS

By K. L. Bhatta[1]

I

Seeing is believing. All demonstrations are based on this old, old principle. They are based on the fact that the human mind will accept what the eye records. Demonstrations possess a directness that no spoken or written appeals can achieve. They provide a proof that requires no argument. When we have a new idea to prove or a new gadget to sell, we promptly say, "Let us demonstrate."

Agricultural demonstrations follow much the same principle. They provide to the doubting farmer, an acceptable proof that a new variety of rice, or a new fungicide or fertiliser is better than the one he knows. Not so very long ago, our farmers were unwilling to see, let alone believe. But thanks largely to the untiring efforts of the extension worker, the position is now entirely reversed. Our farmers now *invite* demonstrations. The 'Varietal Demonstrations' in which the superiority of new varieties of crops are shown, did the trick. The farmer saw, with unbelieving eyes, that these 'improved varieties' grew faster and better, resisted drought and frost, flowered and set seed earlier and most important of all—yielded more. This last fact he could not doubt and would not resist. He wanted still better varieties and invited more demonstrations. During the past three decades, improved varieties of almost all important crops, *viz.*, rice, ragi, jowar, sugarcane, cotton, tobacco and potato, were introduced to general cultivation through the medium of these varietal demonstrations.

Apart from healthy seed of a high-yielding variety, the other main factors which influence agricultural production are soil, water and manure. The first two of these are nature's gifts and have to be accepted more or less as they are, although by shrewd management of land and provision of irrigation facilities, these can be modified to a significant extent. The other factor, namely, manure, is well within the farmer's control, and by a judicious and well-timed application of the right

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types of manures and fertilisers, he can, as often as not, double his yields.

That crops respond to manuring is not a new idea that we have to instil into the minds of the farmer. He knows it quite well. When he sees a poor stand of crop, he immediately says that the land has lost 'strength'. He knows too, that to restore this lost 'strength', he has to apply manure. In fact, there is a saying in Kannada which means 'even a dunce can raise a bumper crop if he has manure'. But the average farmer's idea of manure is rather restricted and not quite up-to-date. To him, manure means farmyard manure, silt from canals or tanks, sheep penning on his fields or green leaves being puddled into the paddy flats. He is somewhat wary of these new fertilisers which look like salt and come in bags from factories. He is not fully aware that centuries of cropping has depleted the soils of their plant nutrients and the addition of the usual quantities of the usual manures does not return to the soil, what the corps take out of it. He is not quite aware that the high-yielding new varieties to which he is getting accustomed, make far greater demands on the soil than the old varieties. He has to be taught that the traditional manures, good as they are, important as they are, and necessary as they are, do not fully meet the total requirement of our agriculture and have to be supplemented with the new fertilisers. He has to be convinced that these chemical fertilisers are good for his crops, and good for his fields and do not produce any ill-effect, temporary or permanent, to the land he cherishes for the sake of his children and grandchildren.

Many progressive farmers have responded to the call of the agricultural departments and accepted ammonium sulphate and to a more limited extent, superphosphate as necessary adjuncts to traditional manures. But there are other fertilisers, both nitrogenous and others, which are equally good and useful. Urea, ammonium sulphate nitrate, nitrolime, ammonium nitrate and ammonium chloride among nitrogenous fertilisers, and muriate and sulphate of potash among potassic fertilisers may be mentioned as examples. The cultivator has to be made familiar with these new products and taught their use.

The problem of fertiliser requirement of crops has been studied at great detail in departmental laboratories, pot culture houses and on a field scale, at agricultural research stations. The kinds and quantities of fertilisers, their time and mode

of application, for different regions and crops have been determined. But this basic knowledge available with the agricultural departments has to be tested against the background of varying soil, climate and economic conditions prevailing in different parts of the country. Fertiliser demonstrations on cultivators' fields provide the best testing grounds for the purpose.

Lastly, for any operation to be accepted as a routine of agriculture, it must pay. This is true of fertilisers also. Except under the stress of a national emergency, a mere increase in yield will not appeal to the cultivator, unless such increased yields bring in a proportionate increase in his net income. Demonstrations on his own fields will go a long way to convince him that fertilisers pay.

Keeping these facts in view, the Indian Council of Agricultural Research, in co-operation with the American Technical Co-operation Mission, has sponsored a Scheme of Fertiliser Demonstrations on cultivators' fields, in which all States participate. In the two years during which the Scheme is in operation in Mysore, over four thousand fertiliser demonstrations have been organised in all parts of the State, with a special stress in areas covered by the National Extension Service and Community Development Blocks. In what follows, an attempt has been made to offer a factual summary of the observations made and the conclusions to which they point.

A scientific evaluation of the data collected from the demonstrations, taking into consideration the variations due to soil, climatic and other factors, is being done by the I.C.A.R. and their conclusions will become available in due course. The following is a general summary intended to bring out the main trends of results observed.

II

It is well known that our soils are poor in nitrogen and that most crops respond to applications of nitrogenous fertilizers. Phosphate deficiency is also widespread. During the first two years of the operation of the Scheme, the stress was on the use of nitrogenous and phosphatic fertilisers, singly and in combination, to determine the increases in yield of crops, at levels of application considered suitable by the Agricultural Chemist. Latterly, potassic fertilisers have also been included, but data from these demonstrations are not yet to hand.

PADDY

30 lb. of N
20 lb. of P_2O_5

No Fertiliser.

SUGARCANE

No Fertiliser.

200 lb. of N
50 lb. of P_2O_5

INCREASED PADDY YIELD for BETTER LIVING
AVERAGE OF 89 DEMONSTRATIONS IN N.E.S BLOCKS, MALAVALLI, MYSORE
4276
POUND PER ACRE
2802
NO FERTILIZER
USING 450 LBS. MIXED FERTILIZER
Rs.
ADDL. 1474 LBS. PADDY = 150
FERTILIZER COST = 50
ADDL. NET INCOME = 100
MORE FERTILIZER
NEW ROOFS
SMOKELESS CHOOLA
BETTER POULTRY
BETTER FOOD

The general pattern of demonstrations is to select a flat rectangular field in a conspicuous place and to divide it into three equal parts. The whole field receives bulk manures like compost and farmyard manure in doses usual in the locality. One of the three sub-plots receives no fertilisers and serves as check or control plot. The other two sub-plots are given fertilisers. There may be two different fertilisers or different levels of the same fertiliser. Suitable rules have been framed, to prevent the inflow of water from one plot to another, and to ensure that the field is reasonably uniform in texture and fertility. Randomisation of treatments, etc., have also been provided for, to enable scientific evaluation of the data collected. At the end of the crop season, yields from these plots are recorded separately.

There were three types of demonstrations, designated Type I, Type II and Type III respectively. As the majority of demonstrations during the period under review were on paddy, the data presented here are for that crop.

Type I Demonstrations

In this type, the three plots were as under :

(1) No fertiliser ;

(2) 30 lb. of nitrogen per acre ; and

(3) 30 lb. of nitrogen *plus* 20 lb. of P_2O_5 per acre.

The nitrogen was supplied either as ammonium sulphate, urea or ammonium sulphate nitrate and phosphoric acid as superphosphate. In each locality, the varieties recommended by the Department were used in these demonstrations. The yield data given in the following tables represent the general average for each region and no account is taken of the differences due to varieties or forms of nitrogen.

The data show a definite increase in yield in all regions, due to application of both nitrogenous and phosphatic fertilisers, the effect of N *plus* P being more pronounced than that of N alone. The cost of fertiliser is as follows : 30 lb. of N per acre—Rs. 23 ; 20 lb. of P_2O_5—Rs. 12; Total cost—Rs. 35 per acre. Taking the average price of paddy at Rs. 20 per *palla* or (Rs. 11 for 100 lb.), it is seen that in all regions application of these fertilisers are not only worthwhile but quite profitable.

TABLE I

Table showing the increases in yield due to application of nitrogenous and phosphatic fertilisers to paddy—yields in lb. per acre

N : 30 lb. of nitrogen per acre as ammonium sulphate, urea or ammonium sulphate nitrate

P : 15 lb. of phosphoric acid as single superphosphate

Sl. No.	Region or District	Monsoon Paddy 1954–55					Monsoon Paddy 1955–56				
		No Fertiliser	N only	N + P	Increase		No Fertiliser	N only	N + P	Increase	
					Due to N	Due to N+P				Due to N	Due to N+P
1	Shiralakoppa*	2436	2943	3149	507	712	2060	2500	3070	440	1010
2	Malavalli (N.E.S.)	1780	2149	2739	369	959	3262	3959	4842	697	1550
3	Bangalore	2223	2693	3131	470	908	..	..	..	..	..
4	Kolar	2977	3407	3835	430	858	2183	2838	3681	655	1498
5	Mysore	2915	3513	4117	598	1202	2764	3594	4475	830	1711
6	Shimoga	2445	3253	3363	808	918	2818	3414	4574	596	1756
7	Tumkur	1770	2697	3000	927	1230	3157	3955	4221	298	1064
8	Bellary	4115	4720	5190	605	975	2998	3512	4264	604	1266
9	Chikmagalur	2066	3720	4388	1654	2322	1838	2333	3014	495	1176
10	Chitaldrug	2049	2685	3389	636	1340	2969	3548	4139	579	1170
11	Mandya	..	..	..	..	..	3102	3932	4552	830	1450
12	Hassan	..	..	..	..	..	3811	4450	5000	639	1189

* Rural Community Project area comprising Sagar, Sorab and Shikaripur Taluks.

TYPE II DEMONSTRATIONS

In this type the effect of two different doses of mixed fertiliser is studied. The treatments compared are :

(1) No fertiliser ;

(2) Single dose of mixed fertiliser (30 lb. N *plus* 15 lb. P_2O_5) ; and

(3) 1½ dose of mixed fertiliser (45 lb. of N *plus* 22½ lb. of P_2O_5).

There has been an increase in yield of paddy with the application of fertilisers, highest yields being obtained at the higher level of application although the actual extra yield due to the higher level of application varies from place to place. The cost of fertiliser per acre is approximately Rs. 35 for the first dose and Rs. 52 for the high dose. Taking the price of

paddy at Rs. 11 per 100 lb., the higher level of application seems worthwhile in most places. This higher dose, in effect, works out to 8 (local) *maunds* of ammonium sulphate and 5 *maunds* of superphosphate per acre. (1 local *maund* = 28 lb.).

TABLE II

Table showing increase in yield due to application of mixed fertilisers at two levels to paddy—yields in lb. per acre acre

Sl. No.	Region or District	Monsoon 1954–55					Monsoon 1955–56				
		A No fertiliser	B Single dose of M.F.	C 1½ dose of M.F.	D Increase due to B	E Increase due to C	A No Fertiliser	B Single dose of fertiliser	C 1½ dose of fertiliser	D Increase due to B	E Increase due to C
1	Shiralakoppa (R.C.P. area)	2172	3014	3275	842	1104	2506	3409	3846	894	1340
2	Malavalli	2525	3523	4299	998	1774	2808	4167	4752	1359	1944
3	Bangalore	2223	3877	3244	654	1021	..	..	..	..	..
4	Kolar ..	2218	2820	3157	602	939	2170	2761	3326	591	1156
5	Mysore ..	2915	3639	4192	724	1277	2782	3028	3528	246	746
6	Shimoga ..	2445	3132	3508	687	1063	..	..	..	..	..
7	Tumkur ..	1770	2697	2820	927	1050	..	..	..	..	..
8	Bellary ..	3755	4444	5069	694	1314	2380	2060	3640	580	1260
9	Chikmagalur	2053	4464	4908	2411	2855	2292	3028	3588	736	1296
10	Chitaldrug	2592	3281	3754	689	1164	2733	3343	3938	610	1205
11	Mandya	..	..	..	..	..	2639	3854	4789	1215	2150
12	Hassan ..	..	..	..	..	..	3995	4731	5480	736	1485

TYPE III DEMONSTRATIONS

Earlier in this note, it was stated that in addition to ammonium sulphate which has become a familiar article of trade, there are other equally useful nitrogenous fertilisers which can be used with advantage. Three of these, *viz.*, urea, ammonium sulphate nitrate and nitrolime, will be produced in India in large quantities in the near future. It is necessary to introduce these new fertilisers to the cultivator through the medium of demonstrations, and to assess their relative efficiency as suppliers of nitrogen. Last year, the effect of a standard dose of nitrogen supplied as (1) ammonium sulphate, and (2) as urea were compared. This year ammonium sulphate nitrate was also included. The data obtained are summarised in Table III.

Table III

Table showing yield of paddy obtained with the application of ammonium sulphate, urea and ammonium sulphate nitrate. Nitrogen in all cases was supplied at 30 lb. per acre.

Sl. No.	Region or Disirict	Monsoon Paddy 1954–55		Monsoon Paddy 1955–56		
		Yield—lb. per acre		Yield—lb. Per acre		
		Ammonium sulphate	Urea	Ammonium sulphate	Urea	Ammonium sulphate nitrate
1	Shiralakoppa (R.C.P.)	2845	2920	2635	2900	2785
2	Malavalli (N.E.S.) ..	2801	2591	3342	3435	3921
3	Bangalore ..	2783	2998	..	..	..
4	Kolar ..	2943	2908	2493	2708	3046
5	Mysore ..	3607	3993	4055	4689	4560
6	Shimoga ..	3485	2810	..	..	..
7	Tumkur ..	2681	2591	..	..	..
8	Bellary ..	3868	4060	2620	2580	2640
9	Chikmagalur ..	2889	3024	..	..	..
10	Chitaldrug ..	2620	2855	3744	3833	4372
11	Mandya ..	..	..	3172	3746	3631
12	Hassan ..	..	..	4045	4300	4880

These figures show that in general, there is not much difference between the fertilisers tested, although there are some areas where one or the other has produced a better effect. Urea in Mysore District, ammonium sulphate in Shimoga District and sulphate-nitrate in Chitaldrug District, seem to be better than the others.

The results tabulated in the three foregoing tables, represent the average of all plots in a district. As is to be expected, the actual increase in yield in different parts of the same district vary from place to place depending upon the soil and climatic and other factors. The data for the taluks of Sagar, Sorab and Shikaripur comprising the Rural Community Projects area in Shimoga District, which are given below, illustrate this fact. As large numbers of demonstrations were carried out in each taluk, the yields given may be taken as representative.

RURAL COMMUNITY PROJECT—SHIMOGA DISTRICT

Demonstrations on summer paddy carried out in the two seasons have given results which are in general conformity with those presented in Tables I, II and III above. A limited number

Type I Demonstrations—Monsoon 1954-55

Taluk	Yield per acre			Per cent. increase		
	No fertiliser	N	N + P	No fertiliser	N	N + P
Sorab ..	2528	2999	3267	100	111	121
Sagar ..	1654	2244	2614	100	121	135
Shikaripur ..	2944	3455	3729	100	117	126

Type II Demonstrations

Taluk	Yield per acre			Per cent. increase		
	No fertiliser	Single dose of mixed fertiliser	1½ dose of mixed fertiliser	No fertiliser	Single dose of M.F.	1½ dose of M.F.
Sorab ..	2047	2635	2928	100	128	143
Sagar ..	1838	3136	3264	100	170	178
Shikaripur ..	2802	3944	4217	100	140	150

Type III Demonstrations

Taluk	Yield per acre			Per cent. increase		
	No fertiliser	Ammonium sulphate	Urea	No fertiliser	Ammonium sulphate	Urea
Sorab ..	2403	2905	3038	100	120	121
Sagar ..	1736	2191	2133	100	126	123
Shikaripur ..	2773	3251	3347	100	117	120

of demonstrations on other crops, particularly ragi, sugarcane, potato, vegetables and chillies, have been carried out and in every case there has been a decided increase in yield. Demonstrations on these crops are being extended in the current year and an objective assessment of the effect of fertilisers on these crops will become possible next year.

III

In a preliminary survey of yields as influenced by fertilisers, it is not possible to go into great details and make a critical assessment of costs and returns for each locality. This is being done separately for the benefit of local extension workers and

the people whom they serve. It can, however, be stated, that these demonstrations, which are being continued and extended, have shown beyond doubt that fertiliser applications are profitable anywhere. Mr. R. H. Engle, Fertiliser Consultant to T.C.M., has designed a picture (Photo 1) which shows at a glance, what the extra yields may mean to the average farmer. The picture is based on factual data collected in demonstrations at the National Extension Service Block of Malavalli where a large amount of this type of work is being done. It shows, to what extent, a little fertiliser added to the crop at the right time can change the daily life of the farmer and contribute significantly to his housing, health and general welfare.

In an interesting experiment at Nagenahalli, the factors contributing to extra yield of paddy—when grown by the Japanese method—were analysed. Marks were allotted to the several factors, *i.e.*, selection of seed, raised nursery, line planting, application of fertiliser, etc. The analysis showed that fertilisers were responsible for 20% to 30% of the total increase in yield. The National Planning Commission has fixed 25% increase as the target in food production for the Second Five-Year Plan period. By the simple process of adding requisite quantities of fertilisers to our fields, we can easily achieve 50% of this target, if not more.

Acknowledgement

I wish to express my gratitude to the Deputy Director of Agriculture in Mysore, and to the district officers of the Agricultural Department, for making available to me the data on which this note is based.

I am grateful to Dr. B. Dasappa, B.A., B.Ag., Ph.D., D.I.C., Deputy Director of Agriculture in Mysore, for kind scrutiny of the manuscript.

Photos were kindly supplied by Mr. R. H. Engle, to whom my grateful thanks are due.

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(Received: 16th October 1956)

ARUNA

AN IMPROVED VARIETY OF IRRIGATED RAGI

By K. Gopala Iyengar[1] and C. H. Lakshmaniah[2]

In India, the millet Ragi, *Eleusine coracana,* is grown over nearly 6 million acres. Among the States, Mysore has the largest area of just over 2 million. The crop is mostly found in the southern half of the State, and large-scale cultivation is seen in the eastern districts. Of this area, about 1 lakh is found under irrigation. The actual extent varies from season to season within a range of 60,000 to 120,000 acres. Factors favourable for extending the area of the crop under irrigation are an unsatisfactory monsoon in the previous season, and a short crop resulting in a shortage of supply and high prices.

The districts of Kolar, Tumkur and Chitaldrug have over 20,000 acres each under irrigated ragi. Bangalore and Mandya are next in importance, with just under 10,000 acres in each district. Irrigated ragi in other districts is of no significant importance. In the district of Kolar, Bagepalli and Gouribidanur have 5,000 to 8,000 acres in each taluk. Kolar, Bangarapet, Chintamani, and Siddlaghatta return areas of over 2,000 each. Sira in Tumkur District has around 8,000 acres, and an area of 3,000 acres is contained in each of the taluks of Pavgada, Madhugiri and Koratagere. The highest figure of 10,000-12,000 acres in a year is returned from Challakere of Chitaldrug District. Hiriyur and Molkalmuru grow about 2,000 acres each. Mandya and Maddur of Mandya District grow ragi under irrigation to an extent of 3,000 acres in each taluk, and Malavalli over 1,000 acres. Bangalore Taluk has an area of 4,000 acres, and Channapatna of the same district often raises considerable quantities. The crop is of some importance in Channarayapatna of Hassan and Kudligi of Bellary. A few hundred acres are found in the districts of Belgaum and the two Kanaras.

Locally, where rainfall is low and sowing rains very uncertain, a considerable portion of the total acreage under ragi

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[1] Senior Assistant Botanist, Mysore State Department of Agriculture, Bangalore.

[2] Agricultural Research Station, Mandya.

is raised under irrigation. This amounts to nearly three-fourths of the total area in the taluk of Challakere, Hiriyur and Molkalmuru, about half in Sira and Pavgada, and one-third in Bagepalli and Gudibanda. Throughout the district of Mandya and in Channapatna, a catch crop of summer ragi is common on paddy lands. A monsoon season crop of *nati*[3] ragi followed by a summer one of paddy is frequent in Tumkur and Hosakote. Crops raised in rotation with onion, potato, chilli and sugarcane both during summer and monsoon, is very common over the greater part of Kolar and Bangalore. Usually a very early variety with compact or incurved earheads is preferred for the summer crop. K 1, Challakere gidda ragi, and other such reputed varieties belong to this category. For the monsoon season, a variety of a slightly longer duration is preferred. E.S. 11 and R. 0786, are varieties with compact earheads. Types with open earheads or with top-cured fingers are extensively raised during this season. Such local varieties include the well-known Balepatte, Modur, Konankombu, Marangere, Dharani and Chelukondi. CO. 1 (E.C. 593) also belongs to this group.

Improved varieties already under cultivation are the well known, K 1 and E.S. 11, with green compact earheads, and VO. 1, with green fingers curved at the tip. The comparatively recent R. 0324, an early Coxcomb type with violet earheads, and the late-maturing R. 0786 with green, compact earheads recommended for the monsoon season, are slowly gaining ground.

Since 1947, a collection of varieties was under observation on the Mandya Research Station. Among the numerous local races obtained and tried was one from Bangarapet, known as 3 months *nati* ragi. This was first tried in 1949 and continued subsequently in small bulks. It was found to be early and high-yielding. The collection as such was a mixture of types with violet earheads of the coxcomb, incurved, and top-curved nature, the last being most frequent. A number of selections were made and tried in 1954. Sixteen of them were tried in small bulks. Two selections, 6 and 9, were found to be heavier-yielding than others. These two were then critically compared with K 1. Selection 9 was found to be better than 6. This has now been named as ARUNA and multiplied for release as an improved variety of *nati* ragi for summer season.

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[3] Transplanted or irrigated.

On the Mandya Station, the performance of this ragi in yield trials was as below :

Variety	Yield of Grain in lb. 1954	1955	1956	Average	% of K 1	Duration days
CO. 1 ..	2460	1608	2201	2090	106	132
K 1 ..	2220	1588	2124	1977	100	130
3 months *nati* ..	2130	1600	1987	1906	96	105
CO. 2 ..	1360	..	..	..	..	140
S. E. ..	0·35	5·71	Not	..	..	..
C. D. ..	44·6	644	Significant	..	..	..

Variety	Vigour	Height	Tillering	Earhead	Maturity
CO. 1 ..	Good	3′–4′	Poor	Green, topcurved	Even
K 1 ..	Medium	3′–3½	Moderate	Green, incurved	Uneven
3 months *nati*	Poor	2′–3′	Very poor	Violet, topcurved	Very even
CO. 2 ..	Medium	3	Moderate	Green, incurved	Uneven

A yield of 2,200 lb./acre of grain over an area of 5 acres has been obtained in bulk trials. Thus it is evident that in spite of marked earliness the yield of ARUNA compares favourably with those of longer duration varieties, now being grown.

ARUNA grows to a height of 2-3′, and does not tiller except on the margins of plots or when spaced rather wide. Stem is thick, swollen at node with a band of purple and rather brittle when mature. This results in some loss of yield, if harvest is delayed. Leaves are dark green and closely set at base. The bottoms of the leaves, and the top of the leaf-sheath are hairy. Leaves flare away from the stem when mature. Earhead is purple, rather open, with fingers bent at tips. This open nature is of advantage where webbing caterpillars are common. Fingers are 2½-3″ long with a rachis brittle when dry. Loss occurs due to breakage of fingers if the earheads are not harvested in time. Fingers in an earhead vary from 6-14, 9 and 10 being common. Tendency for branching of earheads is observed, particularly when crops have come up luxuriantly. In ARUNA, earliness is combined with uniform ripening of earheads. Irrigated ragi is well known for uneven maturity which makes it necessary to cut the earheads 3-4 times. In ARUNA over 90% of the crop can be gathered at the initial cutting. Smut has been observed on this variety.

ARUNA is suited for summer. When transplanted early, a green manure crop can be grown after the harvest of ragi and before transplanting paddy. Nursery beds should be well maintained, and adequately manured. Seedlings should be transplanted before they are 20 days old. Fields should be well fertilized, and water requirement of the crop be met in time. Transplanting should be close to obtain heavy yield and uniform ripening. A row spacing of 9-10" and 3-4" in the row, would suit most conditions. Clean cultivation is essential. So also is the prompt removal of earheads when affected by smut.

(Received : 16th November 1956)

ARUNA Ragi Crop.

ARUNA Ragi Earheads.

COLLEGE OF AGRICULTURE, DHARWAR

By Dr. S. W. Mensinkai[1]

I. Introduction

The College of Agriculture, Dharwar, is situated four miles north of Dharwar on the Poona-Bangalore highway and is affiliated to the Karnatak University. Motorists travelling on this highway find it difficult to resist the temptation of speeding up the long approach road and having a glance at the majestic buildings of the institution. During the past eight years of its existence, the institution has attracted a steady stream of visitors who have nothing but unstinted admiration for the imposing structure of the main building with its white cupola, silhouetted against the blue sky, its massive stone frontage with the figure of Goddess cut in low relief and the neatly laid out garden in the foreground, flanked by equally extensive wings of the building on either side.

The spot is ideal for an institution intending to impart instruction and conduct studies in agriculture. Nestled in the greenery of the surrounding hills, the College Estate extends over 1,100 acres in a setting that is entirely rural. With a maximum temperature of about 100° F. in summer and a minimum of about 55° F. in winter, the climate is equable and bracing throughout the year. The farm area displays varied soil types of the transition zone and facilitates the cultivation of almost all the tropical crops under an annual rainfall of 30".

II. History

It was in 1947, the auspicious year of Independence, that this institution saw the light of the day, with considerable propriety, on the Government Farm placed at the other end of the city. In 1948, as a result of the courageous efforts of the present Minister for Revenue, Hon'ble Shri M. P. Patil, who was then the Minister for Agriculture and Forests in Bombay, over a 1,100 acres of land were acquired at Yettingudda. Forty lacs of rupees were required for the buildings, equipment, roads and the land. The administrative building of the institution which was completed in 1951 was formally declared open by the

[1] Principal, College of Agriculture, Dharwar.

Governor of Mysore, Sri. Jayachamarajendra Wadiyar, the same year.

III. Departments, Staff and Their Activities

The main building stands facing west at the end of an approach road half-a-mile long from the Poona-Bangalore highway. In it are situated the Principal's office, auditorium, library, lecture halls and the offices of the Cotton Physiologist, the Grass Research Officer and the Forest Botanist.

The auditorium occupies the middle of the ground floor. All the social functions of the College including the Annual Socials are held here, and films of educative value shown to students at regular intervals. It also accommodates the badminton court and table tennis tables.

On the second floor is housed the College library. The library is adequately stocked with over 5,000 books and 52 periodicals on different agricultural subjects and is decently furnished.

In the southern block, known as Agronomy Block, which forms the left wing of the administrative building, are housed Departments of Agronomy, Agricultural Engineering, Physics and Mathematics on the first floor, and Chemistry on the ground floor.

Facing the Agronomy Block and in the northern direction is the Biology Block which forms the right wing of the administrative building. Here are located the Departments of Botany, Zoology, Entomology on the first floor, and Plant Pathology, Bacteriology and Horticulture on the ground floor.

(*a*) *Professional Staff.*—On the staff of the College are persons of high qualifications and experience, many of whom possess Degrees of foreign universities.

(*b*) 1. *Agronomy.*—Part of the Agronomy Department with its threshing yard, stores and office lies around and beyond the two hostel blocks situated north-west of the main building. The farm extends over 1,000 acres of which about 775 are under cultivation. The soils vary from deep to medium black in the upper areas to grey soils in the low-lying areas. There are also red loam as well as light soils. The black soil is ideally suited for cotton, *jowar,* groundnut and chillies ; the grey soil for

paddy and the red soil for millets such as ragi, *Same*[2] and oil-seeds like sesamum, safflower, niger, etc.

The annual rainfall is 30" on an average and is spread over 7-8 months from April to November. The heaviest precipitation is in the months of July and October. Being situated in the transition zone, advantage is taken of both south-west and north-east monsoons in growing both *khariff* ad *rabi* crops. The *khariff* crops are *jowar*, groundnut, chillies, sugarcane, cotton and paddy. The main *rabi* crops are wheat, gram and safflower. The minor crops are ragi, *navane*,[3] *same*, tobacco, sesamum, niger, horsegram, etc.

In a small area of 4 acres, vegetables are taken with the help of irrigation from an adjoining pond. The main vegetables are brinjals, sweet potatoes, beans and peas, knolkhol, cabbage, cauliflower, ginger, turmeric, cucurbits like pumpkin, ridge gourd, cucumber, bitter gourd, snake gourd, *bhendi*[4] and tomato.

Larger irrigation facilities from Kelgeri Taluk are expected to be made available shortly, which would make it possible to put about 20 acres under perennial and 10 acres under seasonal irrigation.

Attached to the Department is a smithy and carpentry unit. The Farm possesses a Zetor tractor and is expected to receive a TD-14 tractor before long. In addition to a large store-room and office, there is an implement shed containing implements that are used in the different tracts of the Bombay State. Most of the staff are housed on the estate.

This Department concerns itself with the teaching of agronomy. In the first year, the students are familiarised with the implements of the Bombay Karnatak. In the second year, the important crops and their cultivation is taught. In the third year, the students are taught soil management and cultivation of irrigated crops, and in the final year, they are instructed in farm management, farm accounts, climatology and field technique.

2. *Dairy.*—Stretched over 40 acres and parallel to the high way, lies the Dairy Department with its office buildings, staff quarters, cattle sheds and poultry house.

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[2] *Panicum miliare.*
[3] *Setaria italica.*
[4] *Hibiscus esculentus.*

Besides doing the routine instruction and demonstration work, the dairy provides wholesome milk to the students and other customers. It consists of a small herd of cows, buffaloes, breeding bulls and young stock. The production of milk per day averages to 150 lb. The animals are milked at 3 a.m. and 3 p.m. everyday and milk is delivered for distribution at 6 p.m. The cow breeds are Sindhi, and buffalo breeds are Pandharpuri[5] and Surti. The breeding bulls are made up of Sindhi, Khilar, Pandharpuri and Surti breeds. The policy of the Dairy is to enlarge the herd and breed for milk production from the foundation stock without making any extra purchase of animals. Practical instruction is given in cream separation and in the manufacture of dairy products like butter, *ghee*,[6] ice-cream, cheese, etc.

A small goat and sheep farm is maintained primarily for teaching purposes. A poultry farm is going to be attached shortly. The Dairy has two silo pits to ensure proper feeding when there is no grass or other green fodder. The capacity of each silo pit is $1\frac{1}{2}$ lakh lb.

Almost the entire staff of the section is housed on the Estate.

Instruction in animal husbandry and dairying is given in all the four years of the course. In the first year, the students are introduced to the common breeds of livestock and their distribution. In the second year, in addition to sheep, goat and poultry breeds of India, they are acquainted with the cattle breeds in greater detail. In the third year, they are taught the breeds of animals for milk production. In the fourth and final year, feeds and feeding, care and management of livestock, manufacture of dairy products as well as dairy management make the bulk of instruction.

3. *Veterinary Science.*—The Veterinary Department, which is situated in line with the dairy alongside the highway, works in close collaboration with the Dairy Department. The subject of veterinary science is reserved for the final year and deals with not only the theoretical aspect of the health and disease of animals but also the practical aspect of treatment and prevention of diseases. Accordingly, the student is taught anatomy

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[5] Also called Nagpuri or Dharwar breed.

[6] Clarified butter.

and physiology of animals as well as medicine and its administration.

In addition, the Department does a good deal of extension work in attending to the sick and diseased animals coming from round about villages.

Most of the staff are accommodated on the Estate.

4. *Horticulture.*—Extended over the slopes of the hill and its base, lies the horticultural garden in the south-west direction about three-quarters of a mile from the main building.

The garden occupies 21 acres and the main activities are : (1) Growing fruit crops like mangoes, bananas, *chiku,*[7] pomegranates, figs, grapes, citrus varieties and papaya, and (2) Maintaining a nursery for quality grafts like mangoes, guava, grapes, *kagdi* lime, figs, etc. The grafts are prepared and sold to fruit-growers.

Also, there is an afforestation area of 65 acres on the slopes of the hill adjoining the garden. There, on the slopes, a variety of fruits like mango, *chiku* and cashewnut are grown.

This Department is concerned with teaching for the fourth year students principles of horticulture, ornamental garden and fruit preservation. In addition, extension work is undertaken which consists of rendering advice in the establishment of fruit gardens and problems concerned with it.

5. *Botany.*—The subject of Botany is taught in the first three years of the course. In the first year, the students are introduced in a general way to the subject and are taught the external and internal structures of plants together with their classification. In the second year, they are taught the physiology of plants dealing with the metabolic activities of plant life. Weed control, care and management of grass lands also form part of this year's teaching. In the third year, the students are introduced to the subject of Plant Breeding and are given the basic knowledge in the evolution of varieties suitable for the tract. As a preparatory training for the purpose, they receive detailed instructions in cytology and genetics.

Attached to the Department and covering four acres is a small economic botany garden adjoining the administrative

[7] *Achras sapota,* Sapodilla plum.

building which grows plants for the classroom practicals as well as for research purposes.

6. *Chemistry.*—Like Botany, Chemistry is taught in the first three years. In the first year, the student is initiated into the elements of Inorganic Chemistry. In the second year, he is introduced to Organic Chemistry as well as to the physical study of soil and soil water. In the third year, they are taught Agricultural Chemistry which deals with the analysis of plants, dairy products and feeds of animals.

In addition, the Department does the Extension work which is to analyse manure, water for irrigation and make appropriate recommendations to the public for use to the important agricultural crops.

7. *Zoology-Entomology.*—Zoology is taught for one year in the first year where the student is given the fundamental knowledge of the animal kingdom and its classification. Subsequently in the third year he is introduced to the subject of Entomology, dealing with insect pests of crops and their control measures.

The Department also does Extension work by giving expert advice in the control of damage caused by insect pests to crops and to stored products.

8. *Plant Pathology-Bacteriology.*—Like Zoology-Entomology, Bacteriology and Plant Pathology are taught only for two years, *viz.*, the second year and the third year of the course. In the second year the student is acquainted with General Bacteriology, including the bacteriology of soil, water, milk and manures. After getting this preparatory training, the student is introduced to Plant Pathology which deals with the detailed study of plant diseases of economic importance and their control measures.

Like the Entomology Department, the Plant Pathology-Bacteriology Department does advisory work whenever there is an outbreak of disease to the agricultural crops.

9. *Physics, Mathematics and Agricultural Engineering.*—This Department teaches Physics, Mathematics and Agricultural Engineering and instruction is spread over 3 years.

In the first year, the student is taught Physics and Mathematics. Under Physics, he learns properties of matter, dyna-

mics and heat. Under Mathematics, his study comprises algebra, geometry, trigonometry, elements of mensuration and biometry. In the second year, he is taught magnetism, electricity and meteorology which deals the elements of weather, formation of winds, clouds, rains, etc.

After this groundwork in Mathematics and Physics, the student is introduced to Agricultural Engineering in the final year which involves a knowledge, both theoretical and practical, of soil conservation, land drainage, irrigation, surveying and levelling, building and construction of farm structures, farm roads, and of machinery like tractors and oil engines.

10. *Agricultural Economics.*—After a preliminary acquaintance with the fundamental aspects of sciences like Botany, Zoology, Entomology, Chemistry, Bacteriology-Pathology and the practical aspects of Farm and Dairy, the student is taught Elements of Economics in the third year. This instruction is followed by Agricultural Economics in the final year which deals with the applied aspects of Economics and equips the student with the knowledge necessary for running the farm economically from the standpoints of production and marketing.

IV. Research

Excepting the Veterinary Department, all the departments have undertaken both fundamental and applied research work which is published separately every year.

V. Museums

As a source of interest and information, both to the laity and the students, all departments are equipped with museums which present very vividly the departmental activities. The Agronomy Museum, for instance, gives a complete picture of the farm, the cropping scheme and the research experiments. It also stores samples of improved seeds of all crops suited for the Karnatak area. It thus gives a thorough guide to those who do not have the time or the patience to go round the extensive farm.

VI. Other Activities

(*a*) *College Gymkhana.*—The College Gymkhana consists of a Chairman nominated by the Principal who himself is the *ex-officio* President of the Gymkhana. The Chairman is assisted by a General Secretary and Secretaries for the various games, both indoor and outdoor, who are elected from among the students.

Facilities exist for both indoor and outdoor games. Table tennis, badminton and carrom form the indoor games which are played in the Auditorium. Cricket, hockey, football and volleyball are the main outdoor games, which are played on the spacious full-size playground situated parallel to the Poona-Bangalore highway.

The Gymkhana publishes every year a magazine which contains articles of popular and scientific interest, contributed by students and staff members.

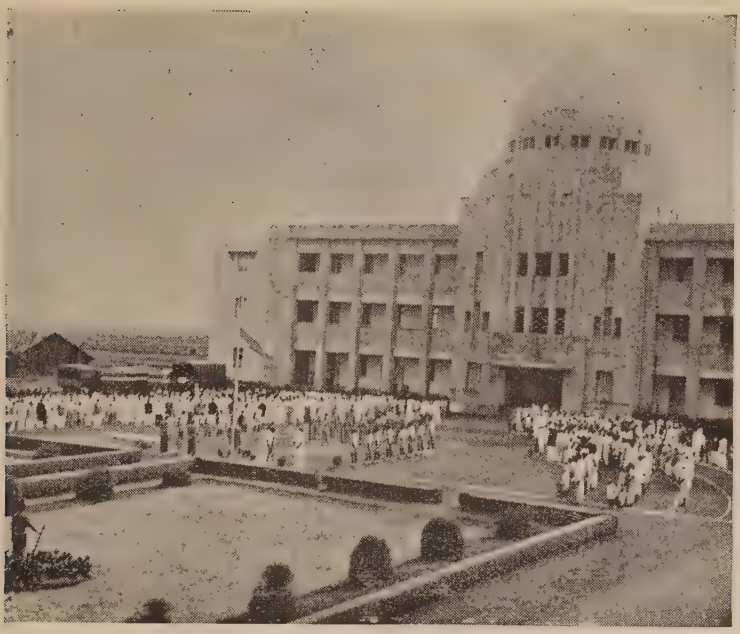
College Co-operative Consumers' Society.—On the site, in the south-east direction from the main building, there is a shop of the College which caters to the daily needs of the estate dwellers and supplies stationery including the journals and other articles to students.

College Dispensary.—Almost alongside the College Co-operative Consumers' Society, there is a neat dispensary facing north, which is in charge of a visiting medical officer and a resident compounder, which looks after the health of the students and the estate residents. Arrangements exist for speedy transport of emergency cases to the Civil Hospital which is situated in the City.

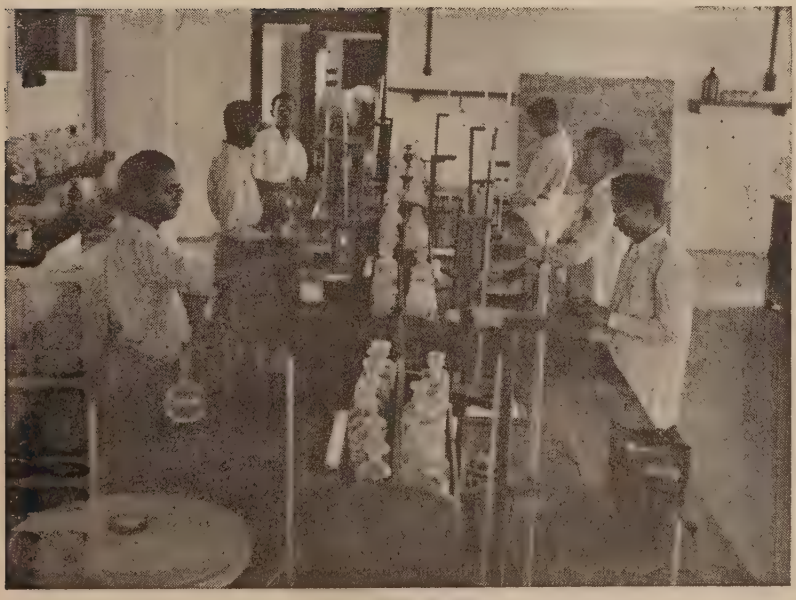
The Course.—The College provides instruction to students in a four-year course of agriculture leading to the Degree of B.Sc. (Agri.). Admission is open to those who have passed the S.S.C. Examination of the Karnatak or any equivalent examination of other States, Universities or statutory bodies recognised by the Karnatak University.

The College also admits for a three-year course students who have passed Inter Science with Physics, Chemistry and Biology of the Karnatak University or an examination of other Universities recognised as equivalent by the Karnatak University. Such students will be admitted for the Second Year Class and they will be required to pass in Agronomy and Animal Husbandry, Mathematics, Biometry of First Year (Agri.) in addition to their second year subjects. They will further be required to obtain a certificate of having attended classes in Smithy and Carpentry.

Facilities also exist for post-graduate studies leading to the Degree of M.Sc. (Agri.) in Animal Husbandry and Dairying, Plant Pathology and Bacteriology, Agricultural Economics,



The Main Building of the College of Agriculture, Dharwar.



Chemistry Laboratory, College of Agriculture.

Agronomy Museum, College of Agriculture.

A *Chiku* Plant in the Horticultural Garden.

Entomology, Horticulture, and the Ph.D. Degree in Agricultural Botany.

Scholarships.—Four merit scholarships, each of the value of Rs. 20 per month, are open to the students for each of the four classes. In the case of First Year, scholarships are awarded to those who have secured more than 50% of the total number of marks at the S.S.L.C. Examination. Merit scholarships are awarded to students whose parents are ordinarily residents of the Bombay State.

In addition, scholarships of Rs. 40 per month are given to students of backward classes, during all the four years.

(Received : 24th December 1956)

FEEDING OF MILCH CATTLE

By H. S. Lakke Gowda[1]

It is generally known that the nature of food exerts a significant influence upon the health and development of all animals, including man. Food is necessary for the maintenance of life and other life processes such as circulation, breathing, etc. Food also takes part in the replacement of wear and tear of the body. So, the quality of the feed that is to be fed or consumed must be able to supply all the essential nutrients which can be used to replace the wear and tear of the body and at the same time to produce any animal products such as meat, milk, egg or wool.

Of all the animal products, milk occupies an unique place as it is the most commonly and abundantly used product of livestock. It is well known that milk is considered to be a whole diet consisting of all the essential nutrients. No other single food is so complete in its composition as that of milk. It is because of this value of milk, that more attention is paid to this aspect of animal product. Milk contains high percentage of protein as well as calcium and phosphorus. The food that the cow consumes must be able to provide all these nutrients in proper amounts. In addition to the production of milk, the cow must also maintain itself in good health. In order to cope with the continuous drain from its body in the form of milk, the animal must get the necessary nutrients through its feed.

The principles of feeding can be divided into two parts. The first part consists of feeding the animals only for its maintenance and the second part consists in giving a production ration. This production ration depends upon the nature of the product. It may be for the production of work, milk, eggs or wool. All animals must get their maintenance ration first. This is fed just sufficient to enable the animal at rest to carry the life processes such as breathing and circulation of blood, without gain or loss of weight. The next attempt is to feed the animal with the ration for production.

For all purposes of feeding, a sufficient amount of 'dry matter' should be provided to all the animals. The dry matter

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[1] Formerly of Mysore Serum Institute, and now Senior Chemist and Assistant to Chemical Examiner, Public Health Institute, Bangalore.

consumption varies with the live-weight of the animal and also with the nature of production and sometimes with the species. For example, cattle will eat about 2-2·5 lb. of dry matter per 100 lb. of body weight and the milch cattle will eat little more. Buffaloes are heavier eaters than cows. It is necessary to feed the animals with roughages or hays, which form the major portion of the ration. Usually they are given *ad libitum*. By feeding enough roughages, we are not only supplying the dry matter to the animals, but also the total energy required by the animals in the form of carbohydrates.

Next we have to look to the 'digestible crude protein' which can only be supplied by the oilcakes or cereal by-products or by some of the protein-rich green substances. The quantity of these concentrates to be fed, depends upon the protein content of the stuff and also upon the purpose of feeding. The dairy cows which have to produce milk will have to be given, over and above that of their maintenance requirement, additional allowance of all the nutrients for milk production. This extra nutrient required for milk production varies with the fat content of the milk. It is found that for every increase of 1% in the milk there must be an increase of protein per cent. of the feed by 0·5%. From the consideration of many foreign data, the allowance of protein for production should be at least 125% of that secreted in the milk. The milch animals in their advanced stage of pregnancy must get extra allowance over and above that of her maintenance ration. The maintenance ration is usually calculated according to the body weight of the animal and the ration for milk production is calculated according to the quantity and the fat percentage of the milk. In feeding the milch cattle, attention should be paid to the fact that the maintenance requirement is met by dry and succulent roughages *plus* a small amount of concentrate like cakes or brans or a mixture of concentrates. Then a concentrate or a mixture of concentrates is fed to individual animals in proportion to their milk production. The concentrates or the concentrate mixtures depend upon the availability and the purchasing capacity of the owner. Some of the common protein-rich oilcakes that can be used in our country are cotton seedcake, groundnut cake, rape seed, gingelly cake, cotton seed meal and some of the common cereal by-products such as rice bran, gram husk and wheat bran. In case of non-availability of any of these concentrate feeds suitable leguminous feeds can be substituted to a certain extent in the case of poor and medium milkers. Deficiency of protein

in the diet brings about the reduction of milk yield and continued deficiency will expose the animals to many disorders.

Though 'minerals' are not taken into account in computation of ration, it is absolutely necessary to feed all the animals in general and milch and growing animals, in particular, with large amounts of minerals. About 1-2 oz. of common salt is fed to all adult animals in some farms. It is better to mix this common salt and also the mineral mixture, if any, with the concentrate feed. This increases the palatability of the concentrate. Apart from the elements supplied, thus, by common salt, the other minerals which require particular attention, in rations of milch cattle are calcium and phosphorus. All the other minerals which are generally found in the milk are supplied adequately by the commonly used feeds. The concentrates, including the cereal brans, are all rich in phosphorus but are poor in calcium. It is necessary to feed the milch animals with some calcium and phosphorus-rich rations. If no leguminous fodders are provided, there is bound to be deficiency of calcium, which must be supplied through some common mineral mixtures. A cow of average body weight (400-600 lb.) requires for maintenance about 1½ oz. of lime as calcium oxide and about 1 oz. of phosphorus pentoxide daily and for the production of about 10 lb. of milk, an addition of about ½-¾ oz. of lime and about 1 oz. of phosphoric acid must be supplied. These figures vary according to the milk yield and are only rough estimates. It will be on safer side if about 2 oz. of mineral mixture is fed to the lactating animals daily. The most convenient way of preparing the cheapest mineral mixture is as follows : common salt, 50% ; finely ground chalk, 25% ; and sterilized feeding bone flour 25%. When such mixtures are fed, there is no necessity of giving extra common salt. However, it is always advisable to feed the animals with bricks of rock-salt which can be kept in the farm or in the cowshed where the cow can lick it, whenever she desires. This ensures the milk yield without any reduction and this is particularly so in the case of heavy milkers. Usually this mixture can be fed at 3% of the concentrate mixture.

If proper supply of calcium and phosphorus are not given in particular lactation, the flow of milk may be reduced and the animal becomes very weak and depleted and if this deficiency is not made up even after the period of lactation, then

the subsequent lactation will be affected and finally it will shorten the productive life of the animal.

Vitamins must be supplied in the feed of all the animals but in the case of lactating animals they not only serve as essential nutrients for physiological functions involved during lactation but also as components of the secretion itself. Vitamin B and C are synthesised in the rumen of the animals; hence there is no necessity of these two water-soluble vitamins to be fed for this class of animals. In a country like India, where the animals can be exposed to sunlight, the need for vitamin D is also limited. The most important one from the point of cattle nutrition is vitamin A, which must be provided in a feeding stuff. If sufficient green pastures are available for the grazing of the animals, the need for vitamins A, B, C, D and E is fully satisfied. The ordinary dry feeds which are fed to the animals as a main portion of the ration does not contain any vitamins. There is thus, a dire necessity of providing the animals with sufficient amount of green feeds to ensure the required vitamin A potency of the milk and at the same time to keep the animal in good health. The lactating animals must get at least 20-25 lb. of greens every day. If the milk is poor in vitamin A, the offspring is bound to suffer. Till the calf is able to get its vitamins from other sources, the milk must have a high vitamin A potency. Otherwise a costly process of supplying some fish oils is necessary for the calf. Some of the tree leaves are found to be very good source for both vitamin A and phosphorus.

If, for some reason or the other, the animal is not provided with sufficient green feeds, the animal is bound to suffer from many disorders such as intrauterine blindness, ophthalmia in growing animals, abortion and sterility in adult animals or general susceptibility to other infectious diseases. If there is rich grazing as is the case in monsoon then there is no necessity of providing even the milch cattle with further supplements of green feeds for the supply of vitamins. Even the feeding of concentrates for heavy milkers can be reduced to 50% if the green pasture is young and tender but not when it is overripe. There is no need of concentrates at all for poor and medium milker (4-8 lb. of milk per day) if good grazing is available.

Knowing all these important factors, a farmer can be in a position to study whether his animal is getting all the

necessary nutrients from the feed he is supplying. In case he finds that this ration is deficient in one or the other nutrient, he must see that factor is made available to the animal from among his available resources. Cattle in this country suffer mostly from the deficiency of vitamin A, calcium and phosphorus or proteins. If particular attention is taken to see that these are properly fed, in addition to the diet they are getting, most of the problems of animal feeding are solved.

DEVELOPMENT OF CASHEWNUT CULTIVATION AND INDUSTRY IN MYSORE STATE WITH SPECIAL REFERENCE TO SOUTH KANARA DISTRICT

Its Possibilities and Potentialities

By K. Sanjiva Shetty[1]

Introduction

In this note it is my endeavour to draw and focus the attention of the Government and the legislators on the one hand and those that are engaged in active cultivation besides the workers in the Department of Agriculture, both research and extension on the other, to the vital necessity of developing cashewnut cultivation and the consequent industry in the New State of Mysore and more particularly in the South Kanara District where conditions are more favourable.

Cashew is an important dollar earner for the country, bringing as it does, foreign exchange of nearly 14 crores of rupees from the countries of U.S.A., Canada, United Kingdom and Australia. It is particularly fortunate that this is a crop which can be grown without much expert knowledge and it is one that grows on a class of land where other crops fail to thrive.

Historical Background and Economic Importance of Cashew

The cashew (*Anacardium occidentale*) is a native of tropical America. It is reported to have been introduced into the West Coast of India by the Portuguese about 400 years ago for the purpose of checking soil erosion, on the coastal lands. The tree has become so naturalised in the West Coast that it grows well in the waste lands of the West Coast and has attained commercial importance with the demand for cashew kernels from foreign countries. About 14 lakhs of cases valued at Rs. 14 crores are being exported annually to foreign countries such as U.S.A., Canada, United Kingdom and Europe and Australia, the major portion going to U.S.A. In recent years cashew shell oil also is being exported to foreign countries

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owing to the discovery of its utility in the manufacture of a wide range of industrial products. It is estimated that about 1,500 tons of oil are exported from the shores of India. Cashew apple, gum from the bark and timber are the other products of the tree, which are useful to man. In short, cashew plays a prominent part in earning foreign exchange for our country, in providing employment to those engaged in its cultivation, production, industry and trade, besides benefiting mankind by checking soil erosion and providing varied useful products.

Habitat

In India the main cashewnut-growing belt lies in the coastal strip lying between the Western Ghats and Arabian Sea extending from Ratnagiri in the Bombay State right down to Cape Comorin. The main centres of cashew cultivation and production are Ratnagiri and North Kanara Districts, Goa, South Kanara and Kerala. It is cultivated to a small extent in Bengal, Orissa, and former Mysore State and in the Districts of East Godavari, Visakapatnam, Guntur in Andhra State and Tirunelveli, Tanjore, Chingleput and South Arcot in Madras State.

Magnitude of Export Industry

India ranks as the most important producer of cashewnut in the world and holds almost a monopoly accounting for more than 95% of the international trade in cashewnut kernels. The present annual production of cashewnut in India is estimated at about 60,000 tons out of which 80%, *i.e.*, 48,000 tons is accounted for by the West Coast alone. A rough estimate of the proportion of the total production from the important producing areas is as follows :

	%	Tons
Composite Madras State ..	50	30,000
United States of Travancore and Cochin ..	37	22,200
Bombay ..	10	6,000
Bengal ..	1	600
Orissa ..	1	600
Former Mysore State ..	1	600
Total ..	100	60,000

Importance of this Industry to Mysore State

Till recently the composite Madras State was leading in the production of cashewnut out of which the major portion, *i.e.*, about 21,000 tons forming 70% was produced in the West Coast Districts of South Kanara and Malabar. But, consequent on the States Reorganisation, Mysore State has assumed importance in cashew with the inclusion of South Kanara and North Kanara Districts in the New State and hence it is felt that this is the most opportune moment to emphasise on the need to devise measures for the improvements and expansion of its cultivation and industry in the State in general and in South Kanara District in particular. With the gradual expansion of the area and production of cashewnut, the Madras Government thought it fit to start a Central Cashew Research Station at Ullal, Kotekar in South Kanara District and this station has been functioning from 1953 for conducting research on various aspects of cashewnut cultivation besides distribution of quality seedings and planting materials with one regional station at Kotarkara in the reorganised Kerala State.

Possibilities and Potentialities of the South Kanara District

South Kanara District is endowed with all facilities for expansion of this industry and with sustained efforts, the possibilities and potentialities of this district for the development of its cultivation and industry are perhaps, unlimited. It is therefore well to examine the position of the district *vis-a-vis* the following statistics :

1. Total number of cashewnut factories working in South Kanara District : Mangalore, 8 ; Kasargod, 2.
2. Six of the Mangalore factories work for 8/10 months and two others 6/7 months only. In Kasargod, factories are understood to be working only for 2 or 3 months.
3. Total quantity of cashewnuts consumed by all the factories : 22,500 tons.
4. Total quantity of raw nuts produced locally per annum : 11,500 tons.
5. Quantity imported into South Kanara District : From outside districts, 4,500 tons ; from out of India : 6,500 tons ; Total, 11,000 tons.

6. Additional quantity required to keep existing factories going all the 12 months in the year : 4,500 tons.

7. Area of cashewnut cultivation in South Kanara District as per Government returns including Kasargod : 8,559 tons.

It will be seen from the above data, that there is hardly a correlation between the area and production in this district. Proceeding on the basis of average yield of cashewnut at $\frac{1}{4}$ ton per acre, the area in the district must be about 46,000 acres although the area as per return for the district, including Kasargod Taluk is only 8,599 acres, and excluding Kasargod, it is only 5,774 acres. Since cashewnut trees are found scattered all over the district mixed up with other trees and along borders of gardens and roadside, etc., and have not been planted on a plantation scale, the area under cashew does not seem to have been assessed correctly. Proceeding on the basis of average annual production and average yield per acre, the cashew area in this district based on the number of yielding trees must be placed on modest estimate of about 45,000 acres for the old South Kanara District or about 30,000 in the reorganised district, excluding Kasargod, although the returns show only 5,774 acres. This production of the district is however only a fraction of our requirements to meet the demand of factories and for export of cashew kernels. Raw nuts to the tune of 6,500 tons are imported annually into this district from Portuguese and British Africa for curing and processing in the existing local factories. But the total quantity available for these factories from existing production and imports, is hardly sufficient to keep the factories going over for about 8 months in a year. In order to keep the existing factories working all the 12 months in the year, about 27,000 tons of raw nuts are required. Out of this, 11,500 tons only are produced in the district and the remaining 15,500 tons are to be obtained by imports. It should now be our endeavour to produce this quantity also in the district itself for which concerted measures must be adopted to achieve the target.

An additional area of 70,000 acres has to be brought under cashew cultivation in this district to produce about 16,000 tons of raw nuts proceedng on the basis that the average yield of raw nut per acre is between 1/5 to $\frac{1}{4}$ ton. This may be attained gradually in the course of the next 15 to 20 years at the rate of 4,000 to 5,000 acres every year. Cashew tree, being hardy,

flourishes on all types of soil from pure sand to laterite on steep hill slopes and on extremely gravel soils with outcrops of rocks. Heavy rainfall of the district with its high humid climate is conducive to its growth. Nearness to sea is another factor reported to influence the productivity of cashew tree. Satisfactory yields are obtained only within 40 or 50 miles from the coast. From these, it is seen that the South Kanara District is ideally suitable for extension of the cultivation.

Hence all areas not cultivated and classified as culturable waste can be put under cashew. According to statistics of South Kanara District, there is an area of about 2,00,000 acres under culturable waste and another area of 1,00,000 acres termed as 'other fallow lands'. Therefore it may not be difficult to mark out and localise about 75,000 acres out of about 3 lakhs of acres available in this district, besides the areas in the North Kanara District. The new area to be planted under cashew will include both private and Government lands.

As already indicated, the scheme extending the cashew cultivation may be taken up as a phased programme with the target of about 5,000 acres per year. For this purpose, the following assistance by the Government, State and Central, is necessary for the speedy stepping up the area under new planting.

1. *Prompt Assignment of Lands by the Government.*—The lands are to be assigned readily and promptly to all classes of applicants, *viz.*, landless small landowners and big landowners. The extent of area to be assigned may be of any size varying from 5 to 100 acres or more, preference being given to small cultivators. These lands may be granted on a long-term lease of 30 to 50 years and the assessment or rent to be collected after 10 years when the trees attain normal bearing. Permanent assignment may be also considered to create lasting interest with the grower.

2. *Loans to be granted* wherever necessary on the security of plantation in phased instalments to the extent of Rs. 50 per acre.

3. *Provision may be made* for a subsidy by Government to enclose the area planted by putting up mud walls (fencing is not suitable) to the extent of half the cost of erection. A block of 5 acres will cost about Rs. 200 for putting up a mud wall one yard high. Hence a sum of Rs. 100 is to be paid as

subsidy for each block of 5 acres. This concession could be made available to private landowners also to encourage them to set apart a contiguous block of a minimum of 5 acres of their lands exclusively for raising cashew.

The financial commitment for year for bringing out 5,000 acres under cultivation will be :

Subsidy for 1,000 blocks of 5 acres each at Rs. 100 for each block—Rs. 1,00,000.

Loan for 1,000 blocks of 5 acres each at Rs. 50 each—Rs. 2,50,000.

4. The Agricultural Department should supply seeds, seedlings and layers for about 4,000 to 5,000 acres every year, if necessary at subsidised rates.

Central Cashew Research Station, South Kanara District

This Station which was started in 1953 is under the control of a Superintendent assisted by scientific assistants. In this station, research work on all items, particularly on agronomic side is being done. Varieties from different cashew-growing regions of the world have been planted, and studies pursued regarding their suitability or otherwise to this region. Experiments on manuring, spacing, depths of planting and other cultural requirements of crop are under study. This station has also evolved a popular and cheap method of propagating air-layers which are in demand by the cultivators. This Station will furnish information on the scientific improvement of the crop to growers.

Cultivation of Cashewnut

The soil and climate requirements of the crop has already been dealt with. Plantations can be started either by sowing selected seeds *in situ* or by planting seeding already raised in nurseries 4 to 6 months old or by planting air layers. The seedings are to be topped while planting, for better survival. Pits of about 1½′ cube are to be dug during the summer season at about the distance of about 20′. This distance may be up 30′ in fertile lands. The pits are to be filled about 2/3 of the depth with surface soil removed from the pits and mixed with ash or burnt earth. Planting is done at the commencement of the monsoon in June at the rate of 2 selected seednuts for each pit which are to be planted about 2″ deep. The stalk end of

the seed should be upwards. Thinning is to be done if both the seeds germinate and only one is to be retained. The area has to be protected by a mud wall to prevent cattle trespass. Normally, no manuring is done and no information is yet available regarding the type or quantity of manures to be applied. It would be beneficial to do intercultivation during the period of growth to conserve soil moisture and to prevent soil erosion. Trees begin to yield in about 3 to 4 years' time although normal bearing will start from the 8th to 10th year. An individual tree under ideal conditions has been found to yield upto 100 to 150 lb. of raw nuts. Normally, it should be possible to produce about 1,000 lb. of nuts per acre from a well maintained garden although the average yield is estimated at 400 to 500 lb. per acre. The price of raw nut at present is about Rs. 20 to Rs. 22 per *murah* of 63 lb. Hence it can be seen that there is any attractive margin of profit in cashewnut cultivation provided the areas are planted with quality seeds or planting material and proper care is taken against cattle trespass.

KEMPU

An Improved Variety of Italian Millet—*Navane*

By G. Sreenivasa Iyengar and K. Gopala Iyengar[1]

Setaria italica Beauv., the Italian millet or *Navane*, is next in importance to ragi and *jola*[2] in Mysore. The millet is raised over an area of 4 lakhs of acres with an estimated production of 120,000 tons. The district of Bellary commands nearly 75% of the area found in the State. Chitaldrug has nearly 60,000 acres under *navane*. The crop is also frequent in Mandya and Mysore districts. *Navane* is grown on an astonishingly wide range of soils, from thin gravels to the most stiff clays. Like *jola,* there are varieties suited to varied seasons of sowing; *kar*,[3] *hain*,[4] *hingar*,[5] and irrigated summer crop. The crop is either raised as a pure crop or with *akkadi* (crop mixture) rows of pulses or cotton. Sometimes, *navane* itself forms *akkadi* and border rows in other crops. *Kar* and *hain* sowings are confined to red soils and light clays. Here, *navane* is raised pure, or will have *akkadi* rows of *avare—Dolichos lablab*. *Navane* is also sown as *akkadi* and border rows in ragi. Border rows are usually put down with varieties having pronounced bristles or awns. These are locally known as *mobu navane*. *Hingar* sowings are confined to black cotton soils and the crop is frequently associated with *desi* cotton. The latter is often known as *navane hatthi*. Summer crops are frequently grown partly for food and partly as fodder. It is also raised as a substitute for paddy when irrigation facilities are scant. Varieties with branched, spikes—*Jade navane* are frequently met with under irrigation.

Work on improvement of *navane* was taken up on the Agricultural Research Station, Mandya, during 1947-48. Twelve local races were collected and were under study. In one of these (Honakere 4) were found plants having greater vigour than average, with larger spikes, bearing coloured seeds. Local types of this *navane* are known as *ittige* (brick red) or *kempu navane*. Selections totalling 20 in number were effected in

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[2] Jowar, *Sorghum vulgare*.

[3] April-May; [4] July; [5] September-October.

Spikes of "KEMPU".

Crop of "KEMPU".

1948, out of these vigorous off-types. When subjected to yield trials, one of these selections, Honakere 4-8, proved to be a heavy yielder, both in respect of grain and straw. This selection was tried along with local types and was found to give an increased yield of 20% to 40%. Average performance of past three seasons was as below :—

Variety	Yield per acre Grain		Straw lb.	Duration in days
	Pallas	lb.		
Local White ..	3·50	700	2000	105
,, Black ..	4·00	770	2500	125
Honakere 4-8 ..	7·00	1475	3500	120

This high-yielding selection underwent district trials as *navane* 1 and has now been named as KEMPU. In these trials which have been under way since 1953-54, KEMPU *navane* has consistently proved superior to local in parts of Bellary and Chitaldrug. The favourable margin of performance of the improved variety ranged from 25% to 40%. During the adverse season of 1954-55, KEMPU *navane* yielded 6 *pallas* per acre as against 3 *pallas* of local in the taluks of Hiriyur and Jagalur. The composition of the grain is as below :—

Moisture, 10·44%; Ether extract, 5·28%; Carbohydrate, 66·26%; Crude fibre, 7·72%; Crude protein, 10·00%; Soluble minerals, 1·50%; Sand and silica, 1·80%; Total N, 1·78%.

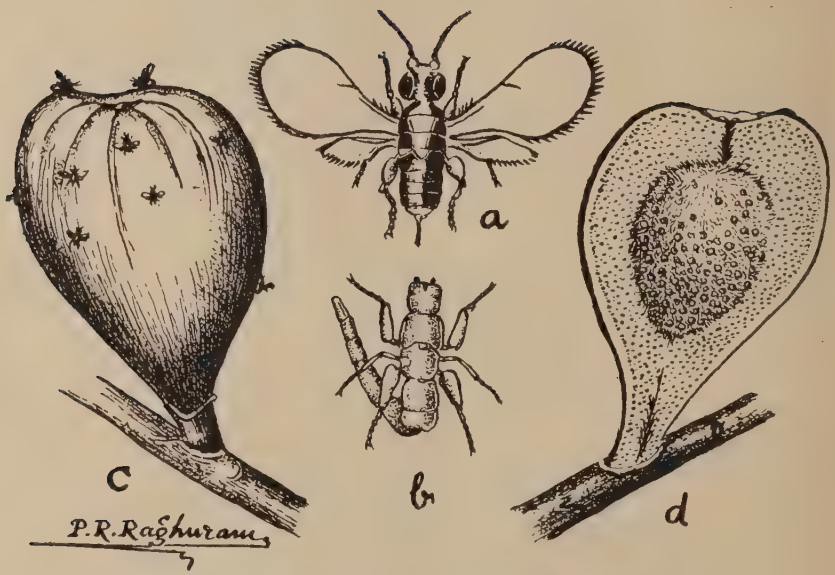
KEMPU *navane* grows to a height of 4-5'. Tillering is poor, culms green, robust, nodes smooth, internodes fairly long (Fig. 1). Leaf-sheath smooth, closely-veined, margins ciliate, ligule short, irregularly partite. Lamina 12-16" long, ½-1" wide, green, linear-lanceolate, acuminate. Midrib distinct with strong, lateral nerves. Spikes terminal, nodding, subtended by persistent involucels of many barbed bristles usually connate at the base. Spike 10-12" long, 1" thick, including the bristles, semi-compact, apex blunt (Fig. 2). Peduncle long and slender, with spikelets in 3-4 spirals, slightly lax at the bottom and densely aggregated above, subsecund on the branches, obovate, 1/3" to ½" long, 1/3" broad, borne on thin very short pedicels, slightly swollen at the junctions (Fig. 3). Rachis creamy white and densely pilose. Bristles thin, stiff, 1/3" long, reflected upwards with barbs on serrate edges. Grain enclosed, loose, large, oval, slightly tapered at one end, smooth, glossy and brick red.

The grain being loose, there is a tendency of shedding in this variety ; and the robust culms slightly detract the straw value. These drawbacks can be overcome by timely harvest and effecting threshing by passing stone rollers. On black cotton soils in the *hingar* season, the improved varieties H. 1 and H. 2 outyield KEMPU with respect to grain but not straw. The variety is not suited for summer season.

KEMPU *navane* is well suited for red soils. It should be grown in the *kar* or *hain* season. Thick stands should be maintained to obtain maximum yields. Harvest should not be unduly delayed, and threshing should be done by passing stone rollers. The colour detracts from the appearance of the grain which is quoted at a lower rate than the white grain in the market. The increased yield of both grain and straw more than offset this lower price.

(Received : 18th October 1956)

Spikelets from bottom to tip of Spike.



The Capri Fig Insect, *Blastophaga psenes :*

(*a*) Female; (*b*) Male; (*c*) Fig with females on it and (*d*) Section of a fig owing flowers and galls.

(*After* SKAIFE, *African Insect Life.*)

THESE FASCINATING INSECTS

By S. Usman[1]

I. How are the Figs Pollinated ?

A fig is a thickened, hollow juicy stem with a very large number of minute flowers lining its inner surface. The only entrance is a tiny opening at the top, surrounded by a ring of small bracts. Insects such as bees and butterflies cannot possibly get inside the figs to pollinate the flowers, nor can the wind carry pollen from one flower to another because they are hidden in the deep cavity in the fig. How are the figs then pollinated ?

One of the most striking illustrations of the dependence of plants upon insects is found in the fact that the figs have associated with them certain peculiar insects, tiny wasps, known as the fig insects, *Blastophaga* spp. (Agaonidæ, Hymenoptera).

The males are wingless, brown and never leave the figs in which they develop. The females are black, winged and very active. They are fertilised inside the figs as they are born. Then they creep out of the small opening at the top of the fig and, in doing so, they pass over the male flowers and get well dusted with pollen. They fly to younger smaller figs on the same or neighbouring trees and creep into them. Thus the pollen is carried from one fruit to another and the female flowers in the young figs are pollinated. The female wasps lay their eggs in the ovaries of female flowers and the larvæ develop in small galls inside them to produce the next generation.

If ripe wild figs are cut open, the larval galls, each about the size of a large pin head, and often the little brown male and the black-winged females, may be found. Most species of wild figs have associated with them their own species of the fig insects.

The most outstanding of them is the capri fig insect, *Blastophaga psenes*, which was introduced into California in 1899 from the Middle East to assist in the cultivation of Smyrna figs. The Smyrna fig is exclusively female and produces no pollen, and therefore it must be pollinated with pollen from the capri fig,

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which is inedible. The little fig insect does this important work and it was only after the introduction of the insect, the Smyrna fig could be successfully grown in California.

II. Light without Heat

Phosphorescence.—The property that many animals possess of emitting light, is one of the most remarkable phenomena in nature. The best known examples are among the beetles, commonly known as fire-flies and glow-worms (*Sampynis* sp., *Luciola* sp., *Lamprophorus* sp.; Lampyridæ, Coleoptera).

The light-producing organ of the fire-fly is found at the tip of the abdomen on the underside. This part of the body is generally yellow, and peculiarly dense and smooth. The outer integument is transparent and beneath it there is a layer of spherical masses of cells filled with a white substance. This layer is well supplied with air-tubes and nerves. Behind this layer is a second layer of cells filled with tiny urate crystals, which serves as a reflector.

The light-producing substance is known as *luciferin* (not phosphorus) and is found in the spherical white cell-masses. It is acted upon by *luciferase,* a ferment contained in the blood of the insect. The light is due to the oxidation of the *luciferin* under the action of *luciferase* and the process seems to be reversible, *i.e.,* the *luciferin* can be used over and over again. Each species has a distinctive rhythm of flashing—the duration of the glow and the time interval between glowing periods; some appear to emit bright flashes, others seem to glow "softly". The insect seems to be able to effect this control by regulation of the amount of oxygen-supply to the luminous organ.

The light emitted by the fire-flies is peculiar in having the maximum of visibility (from 92 to nearly 100% light rays) and practically no heat rays and no infra-red or ultraviolet rays. By contrast, in the ordinary gas flame only 2% of the energy is converted into light rays, the rest being lost as low heat rays; in the electric arc only 10% of the energy produces light; while sunshine is only 35% light. Dr. William McElroy of John Hopkins University has proved, for the first time, that the activating substance in the luminous insects is the same substance as that by which the contraction of human muscles is brought about. The study of luminous beetles continues, not only in the attempt to synthesize the natural substance producing an effect of "cold" light, but in a much wider sense, to

discover the phenomena involved in the release of muscular energy in other animals.

Very little is known about the habits and the life-history of fire-flies and glow-worms. Eggs are probably laid in the soil and among dead leaves. The larvæ are flat, dark brown or white, carnivorous, killing and devouring soft-bodied creatures. Pupation inside the soil. Glow-worms inhabit damp spots and are abundant in summer. The luminous organs are found in the male fire-fly but in the female glow-worm, the larvæ and even the eggs also give a feeble glow. Of what actual use these light organs are to the insects is, however, obscure.

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SECRETARY'S PAGE

The Mysore Agricultural and Experimental Union founded by Late Dr. Leslie C. Coleman in the year 1918 was called "Mysore Vyavasaya Sangha" in Kannada in the year 1949-50. It took up publications of scientific journals in English (Quarterly) and in Kannada (Monthly). This is the only private organisation that has taken up the work of dissemination of scientific knowledge to the farmers of Mysore. The members were conducting experiments on new seeds, manures and methods. Articles of practical nature were published by the experts and by the experienced farmers. Occasional meetings of members, field days and lectures were arranged. Library service and a *ryots'* platform was created from the time of its inception to this day. This is fostered by the Department of Agriculture. The experimental work was taken up by the Department and field days, crop competitions and student farmers' club activities gradually developed. The membership of the Union grew from strength to strength.

The movement of Farmers' Forum and Young Farmers' Association got a fillip from the Agricultural Ministry of the Government of India. It is but keeping with the times and feelings of oneness with all-India movement ; as we are Indians first, and Mysoreans next, the Mysore Agricultural and Experimental Union, in its special general body meeting on 15-11-1956, approved the affiliation with Farmers' Forum, India. The recent developments pertaining to our Association have been : (1) Changes in the Constitution so as to suit to the affiliation ; (2) Programmes drawn to augment the Farmers' Forum functions. In short, besides our activities hitherto in practice our efforts are canalised to form village, *hobli*, taluk, district and State forums. It is but right that the farmers are to be brought together and their voice should be impressive. The time is ripe, that the nation's call for production of more food and more raw materials is translated into the farmers' own plan and gird up their loins for the tasks of the nation.

It is on 4th January 1957, the First Managing Committee of our Mysore Farmers' Forum met for the first time since we changed over. Sri. H. S. Rudrappa, Minister for Agriculture, Government of Mysore, our new President, conducted the proceedings. It was indeed happy corollary that the high officers

and research workers of the Agricultural Department of the new set-up were present on special invitation. Our Director of Agriculture, Sri. M. Mallaraj Urs, the Chairman, presented the staff and members to the President. A brief account of our activities with changes and welcome to the gathering was piloted by the Chairman.

Our work so far and ahead, achievements, finances, and felt needs were graphically explained by the Vice-President Sri. V. Masiyappa, M.L.A. He dwelt at length the need to expand our activities and serve the cause of our farmers. A strong farmers' organisation, he said, was the order of the day to shoulder the great responsibilities of feeding the population of our Indian Republic and all should aid the farmer in the discharge of this noble task. He tabled the needs of the Sangha for funds and help to create a farmers' house at Bangalore for the benefit of teaming *ryot* population and their younger stock—the Young Farmers.

Sri. M. Vasudevamurthy talked about the review of Mr. George Wilson's report on farmers' organisation in India. Some of his own experiences as an ardent worker of our Sangha happily corroborated with those of American Forum President—Adviser to India on Forum matters. He said that the relation between young farmers' movement, children's clubs and our forum is to be planned on our own experience, while clear-cut idea is not yet visualised by many at the helm.

Sri. M. K. Narasimhaiah, while lustfully welcoming Dharwar, Karwar, Raichur, Bidar, Belgaum and Coorg member officers, pleaded for membership drive and planned production. Sri. N. Chicke Gowda, I.F.Y.E., supported his predecessor and laid stress on the efforts of each member on the model of "Each one teach one" on "Each one enrol one". The officers gave a short glimpse of farmers' organisations and their present stages at their places.

Sri. K. V. Byre Gowda, M.L.A., Hony. Secretary, placed the draft plan of action for a year for the consideration of the house. Co-ordinated efforts of all Development Departments and revenue, touring facilities and display equipment were requested from the Government.

The Honourable President was pleased to observe that the *ryots* are to be mobilised in great number to force the recognition of the Sangha and their efforts canalised for stepping up

production. He said he was glad that he was called upon for such a nation-building activity. He assured best considerations for all the resolutions as they are timely and in the interest of the country. Different organisations, he said, are to be merged in this Sangha and efforts concentrated to step up food production from 60 million tons to 80 million tons. Efforts with heart and soul of farmers, workers, Government would implement the desired production within three years. He said the Sangha should work wherever the *ryots'* interests are present and the *ryots* should feel that the Sangha is of them and for them. He said that the latent energies of farm youths should be harnessed for the benefit of the country.

With movie pictures of the first Agricultural Seminar at Hebbal and Young Farmers' Convention at Shimoga and with National Anthem, the meeting came to a close.

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The Young Farmers' Association has drafted a constitution on the model of the Y.F.A., India.

S. V. Haridas,
Secretary.

MYSORE STATE YOUNG FARMERS' ASSOCIATION, CENOTAPH ROAD BANGALORE 2

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SPONSORING FARM AND HOME CLUBS IN BANGALORE CITY AS A PART OF THE YOUNG FARMERS' ASSOCIATION, INDIA, MYSORE

A Club will be a group of boys or girls, at least 10 in number, with a leader. A leader may take the initiative to form a club or a leader may be selected after a club is formed. The number of members in the club may not be more than 20.

Each Club will be affiliated to the Young Farmers' Association through the City Office which will be located along with the Mysore Farmers' Forum, head office. Each Club will pay annually Rs. 5 as affiliation fees. The leader may collect Re. 1 from each member of his Club, send Rs. 5 to the City Headquarters and retain the balance for working the Club.

Each of the Club members will be qualified for the membership on the possibility of he/she taking up a project, that may be allotted to him/her in the school he or she is attending, in the hostel premises where one might be staying or/and in one's own house.

Thus there may be one or more Clubs in a school with a teacher in charge of each Club, there may be one or more Clubs in each hostel with suitably chosen leaders, and there may be Clubs formed by groups belonging to particular institutions or to a particular locality of one or more streets.

The following are some of the projects that city boys and girls may take up.

(1) Kitchen gardening.
(2) Growing flowers and ornamental plants.
(3) Taking care of a milk cow or rearing a calf.
(4) Home furnishing and ornamentation including the use of electricity and sanitary arrangements, white-washing, putting up ornamental structures, etc.
(6) Photography.
(7) Bee-Keeping.
(8) Hand-spinning and dress making.

In the case of photography, the boys who take it as a project will be expected to take trips to surrounding villages and take photos of rural scenes and farmers in action.

Group projects may consist of helping farmers in their fieldwork now and again, doing a bit of spraying or plant protection work during these rural trips and carrying out programmes of *Vanamahotsava.*

There will be three kinds of Clubs:

1. of children below 9 years. Each such Club will give an annual affiliation fee of Re. 1 only;
2. of boys and girls between the ages of 9 to 20;
3. of young men or young women of age between 20 to 35.

The first two categories of Clubs will have leaders proper and Clubs of the third categories may elect their own co-ordinators periodically and these co-ordinators will do the duties of leaders.

According to Association rules, interested persons over 35 years of age may become Associate Members and join in the Association programmes.

All active members will be members, leaders, co-ordinators of one Club or the other.

Each City Club may be brought into contact with a rural Club; and the Clubs will exchange notes; and arrangements will be made for the two Clubs to visit each other once or twice during a year.

For consultation before, during, and after formation of your Club, please meet Sri. M. Vasudevamurthy, B.Ag., C/o. Mysore Farmers' Forum, Cenotaph Road, Bangalore-2.

86-57 Printed at The Bangalore Press, Bangalore City, by C. Vasudeva Rao, Superintendent, edited by M. L. N. Iyengar and published by Secretary, Mysore Agricultural and Experimental Union, Bangalore City.

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